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(54) **MAINTENANCE FACILITATING EXERCISE MACHINE CONSOLE**

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A63B 22/00 (2006.01)

(52) **U.S. Cl.** **482/54; 482/8**

(58) **Field of Classification Search** **482/54, 482/900-903**

See application file for complete search history.

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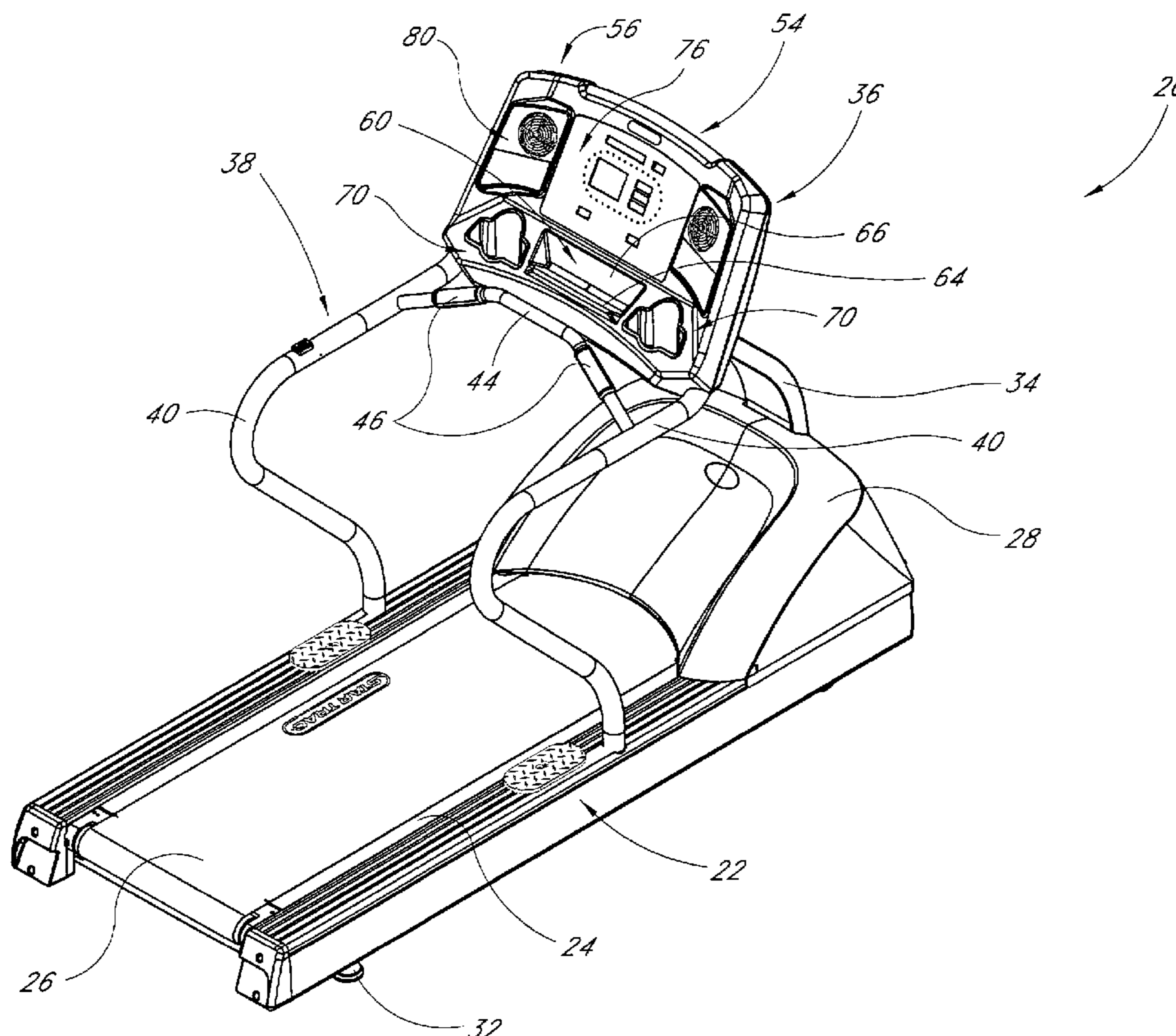
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(57) **ABSTRACT**

An exercise machine, such as a treadmill, has a display arrangement that is configured for easily repair and replacement. The display arrangement comprises a sandwich of a keypad panel, a display panel and an electronics panel. The display arrangement is secured within a console by one or more fasteners and the display arrangement comprises one or more sockets that connect with wires to a power supply and a controller.

20 Claims, 23 Drawing Sheets



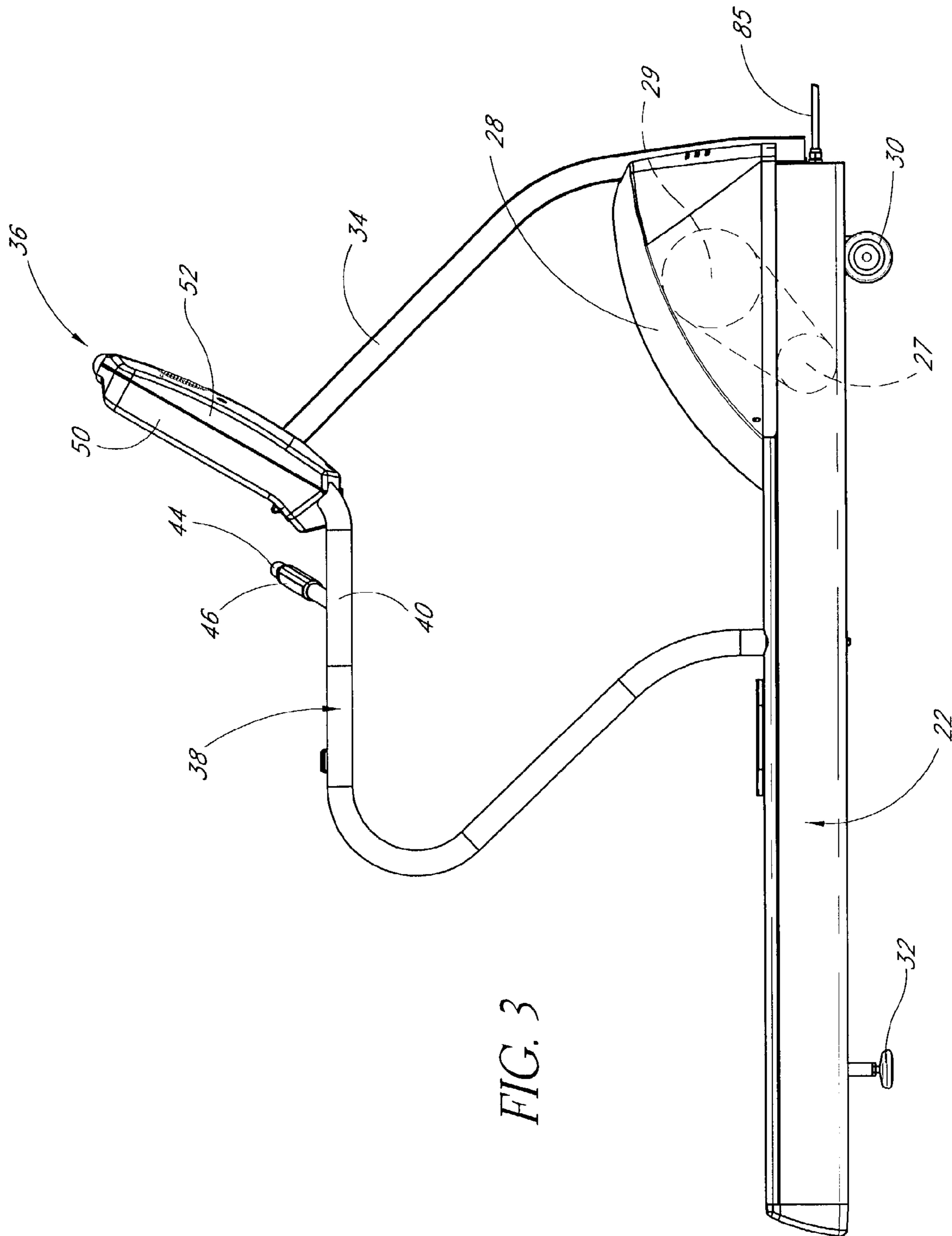


FIG. 3

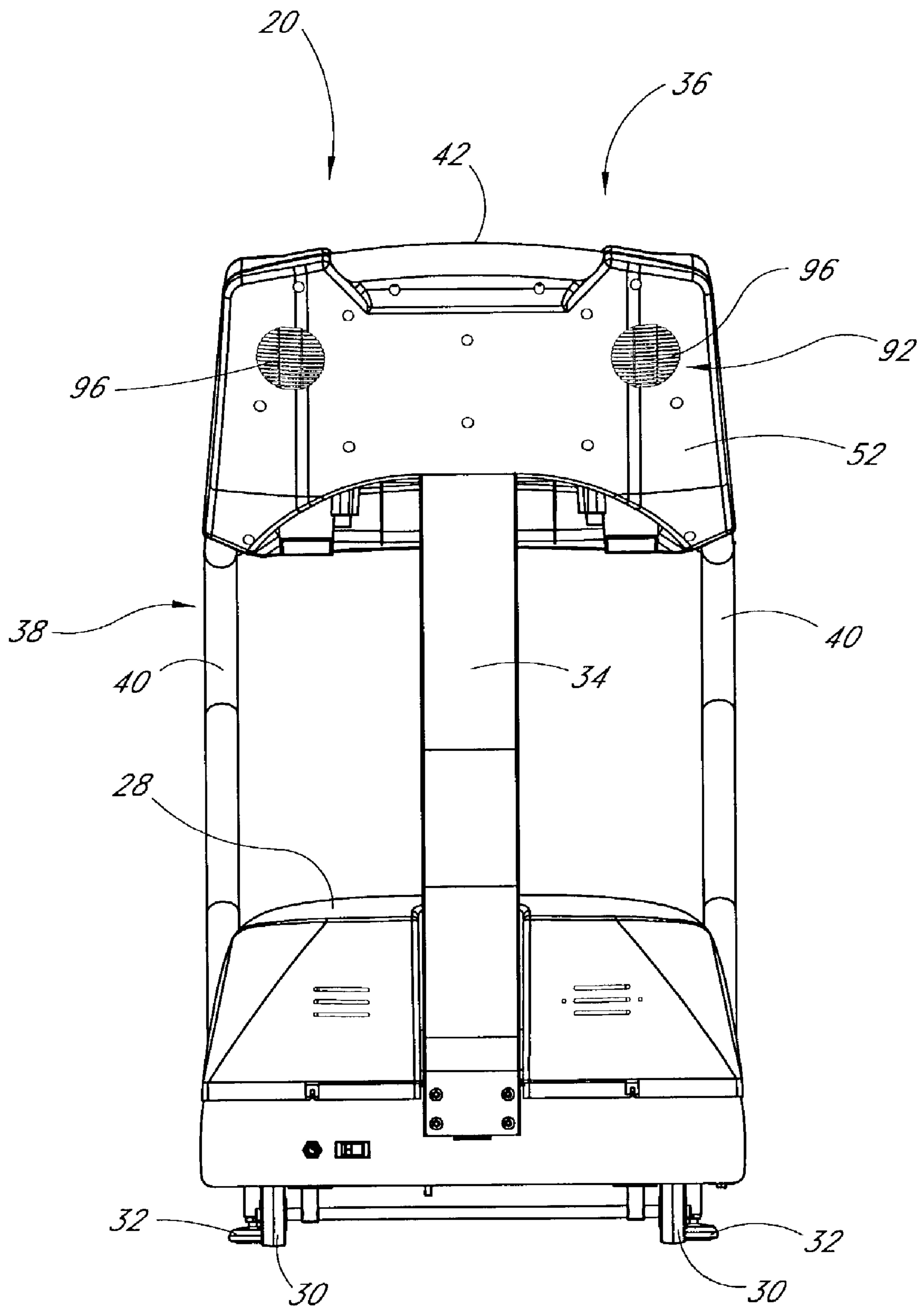


FIG. 4

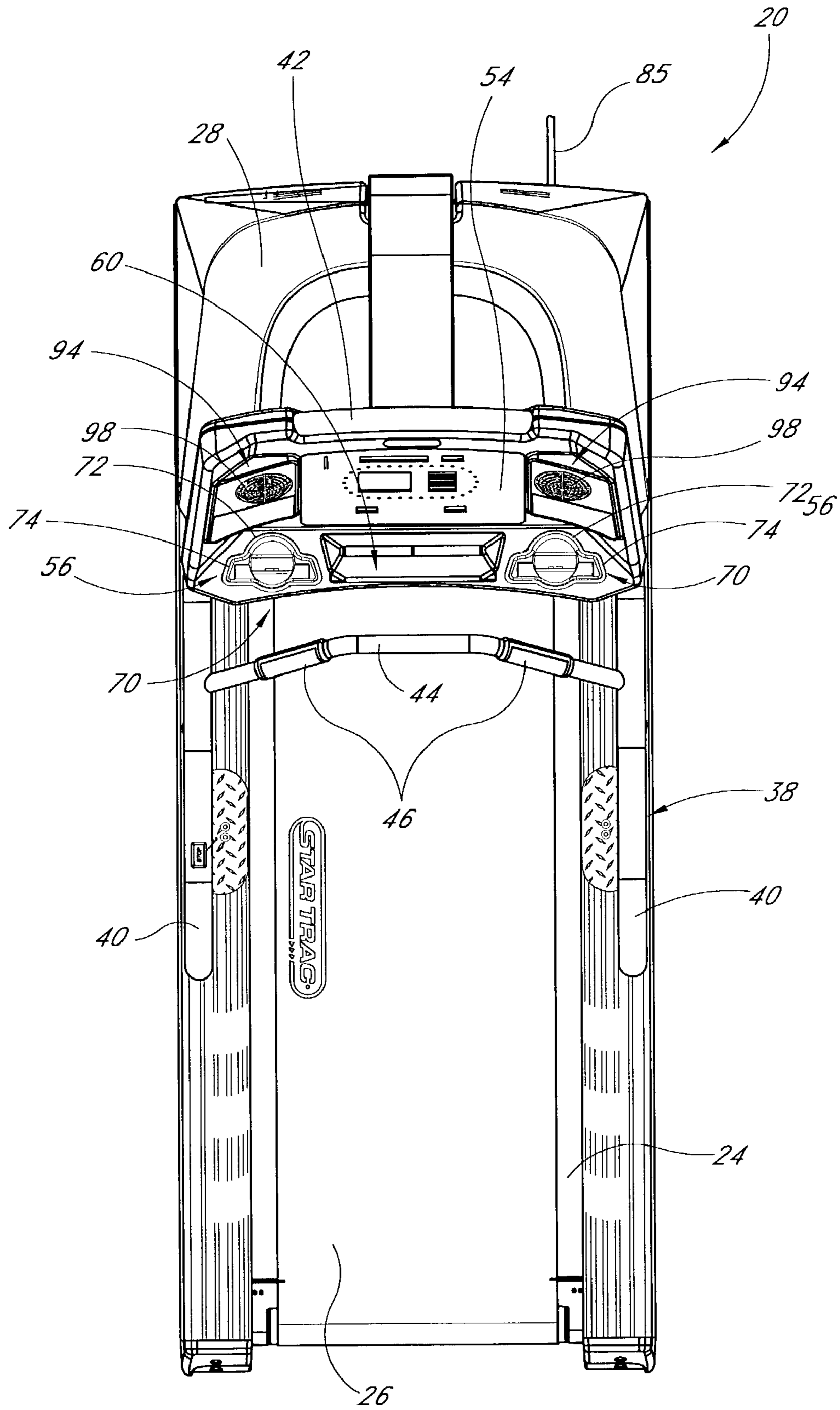


FIG. 5

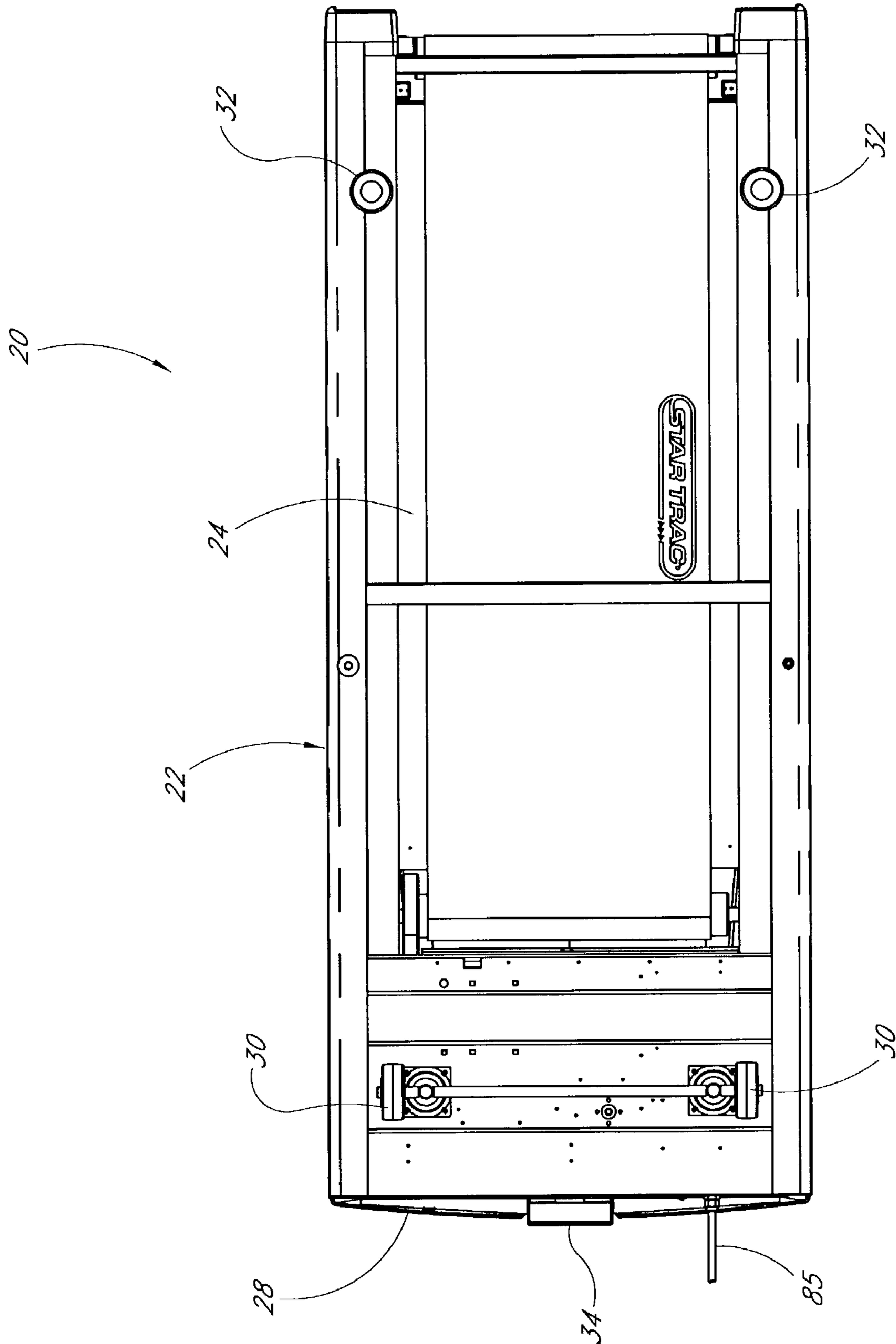


FIG. 6

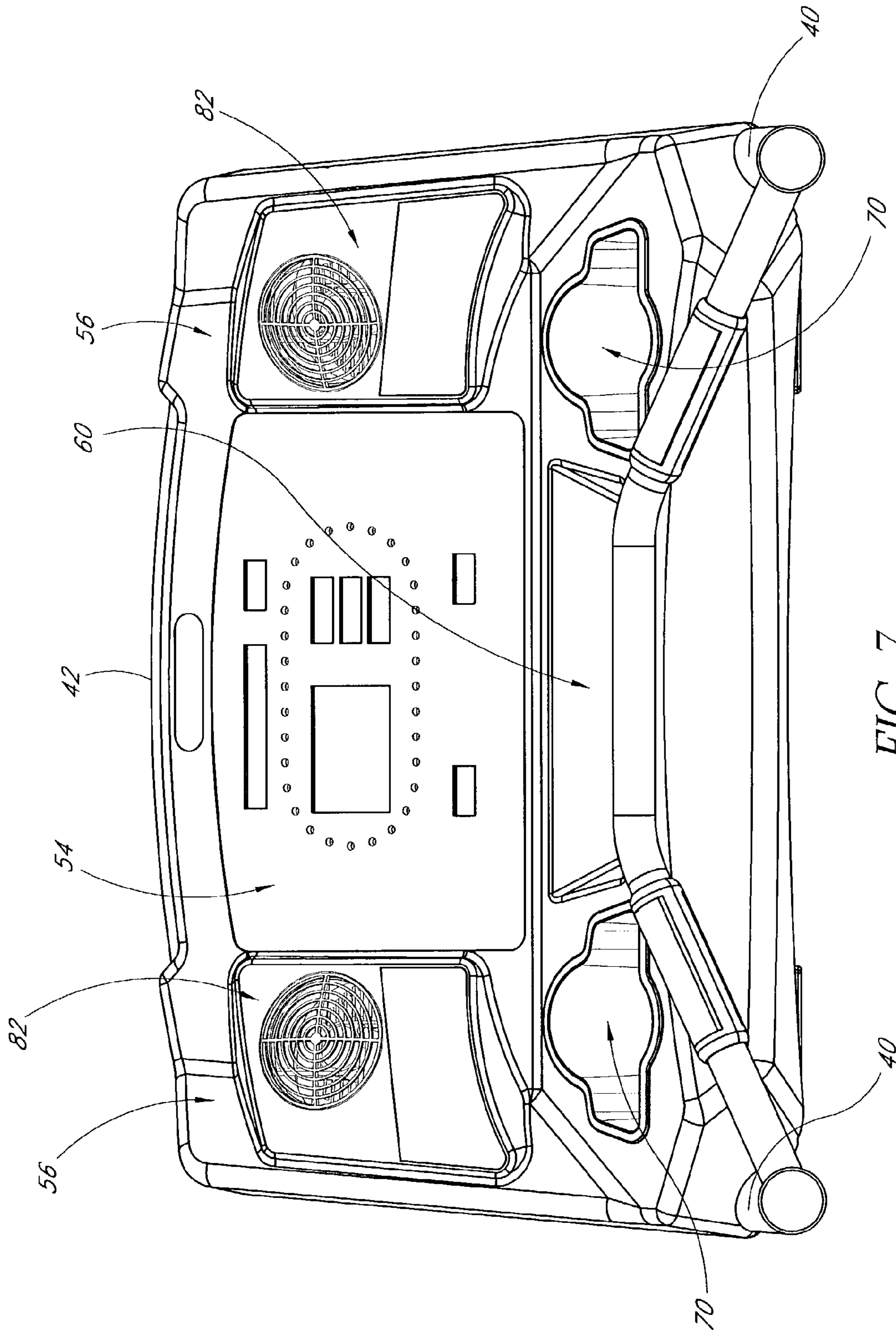


FIG. 7

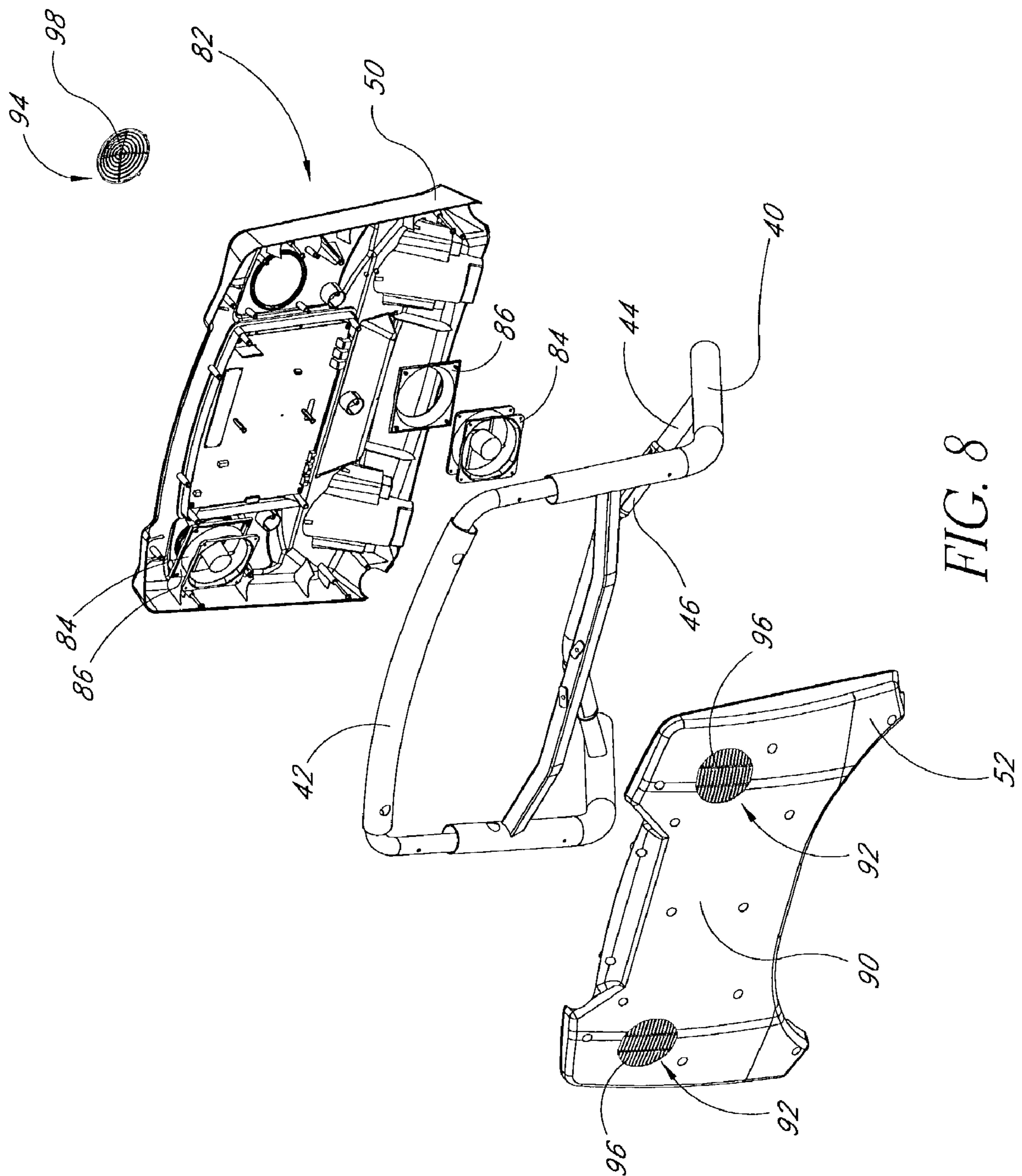


FIG. 8

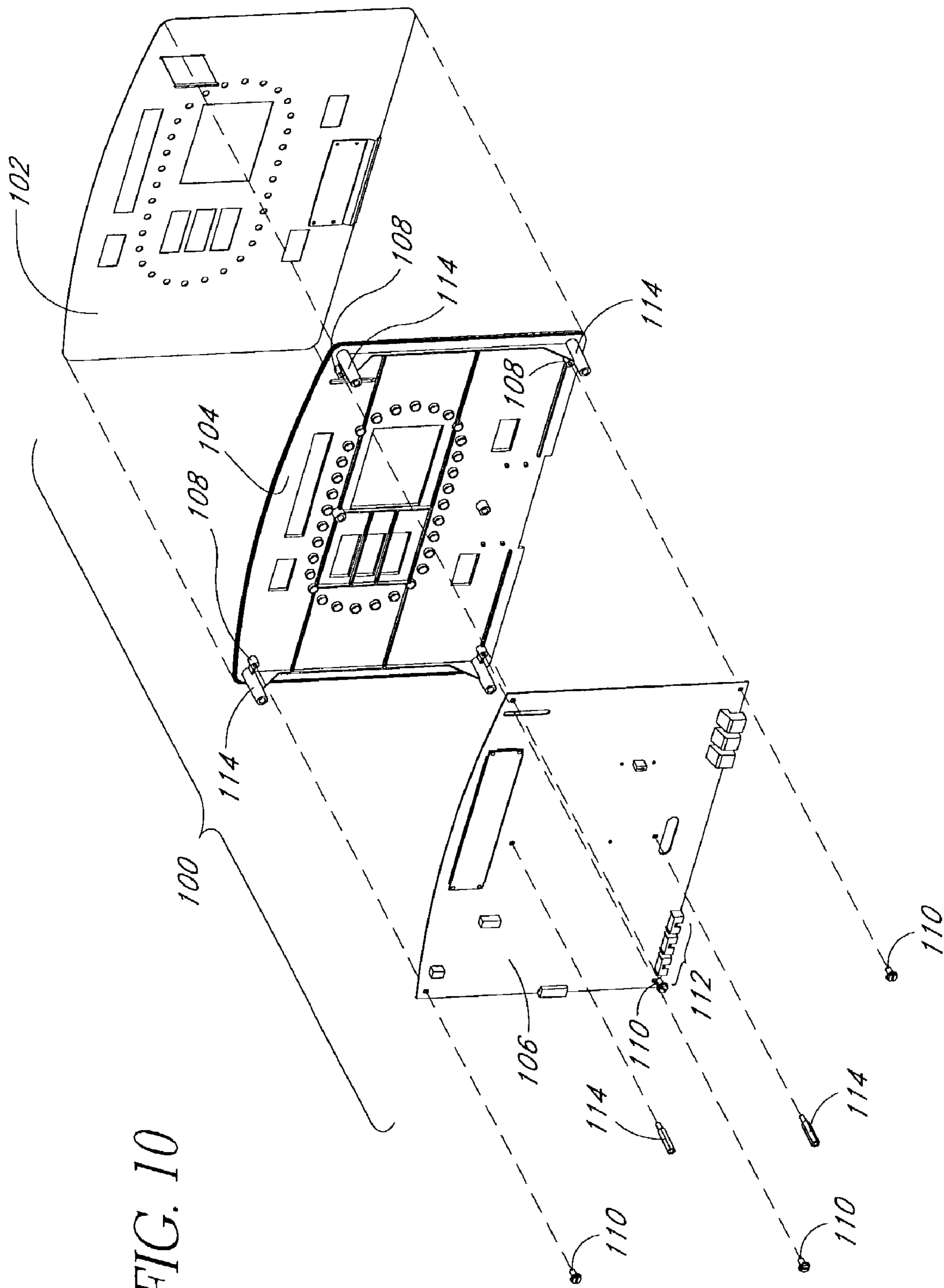


FIG. 10

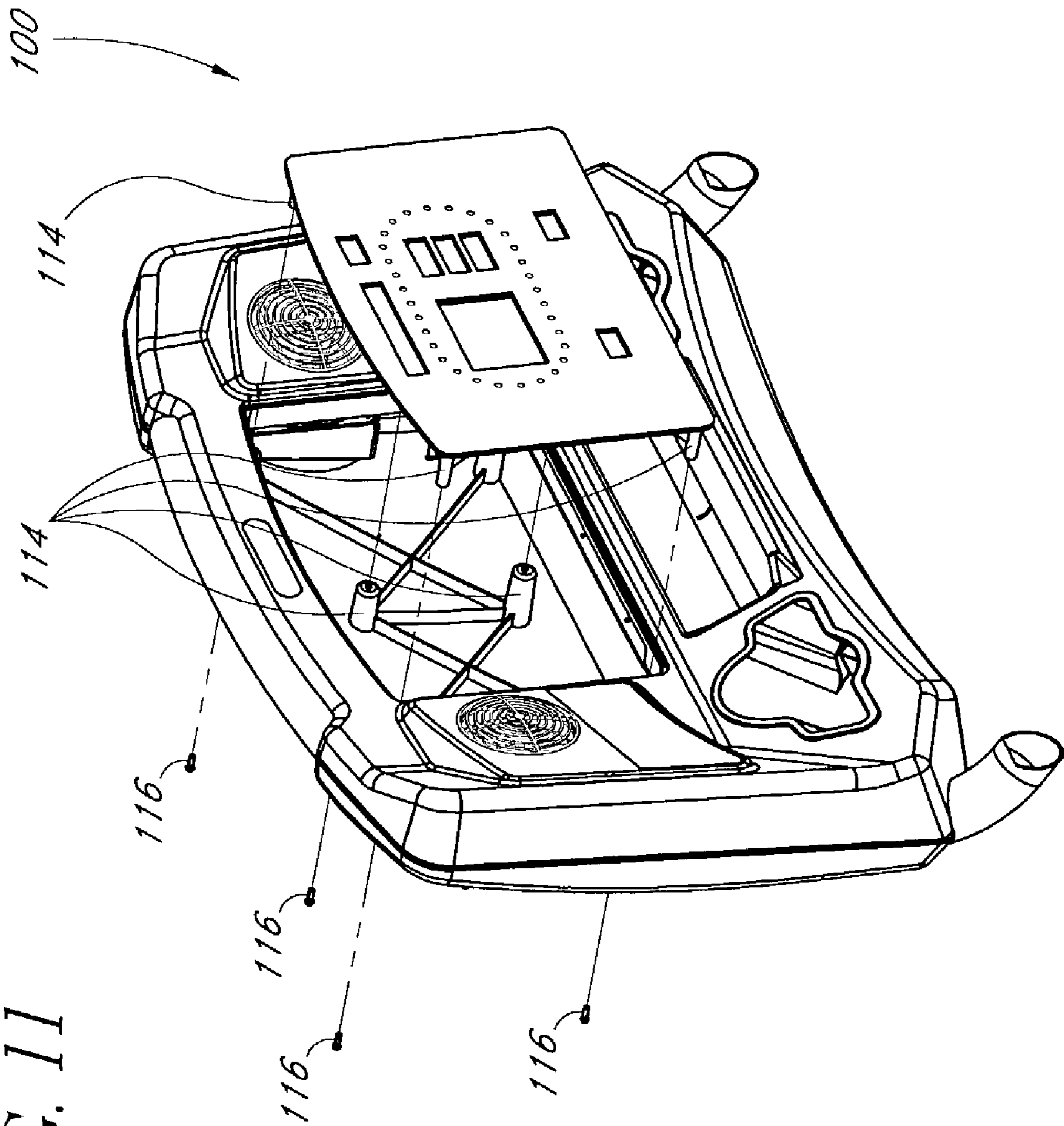


FIG. 11

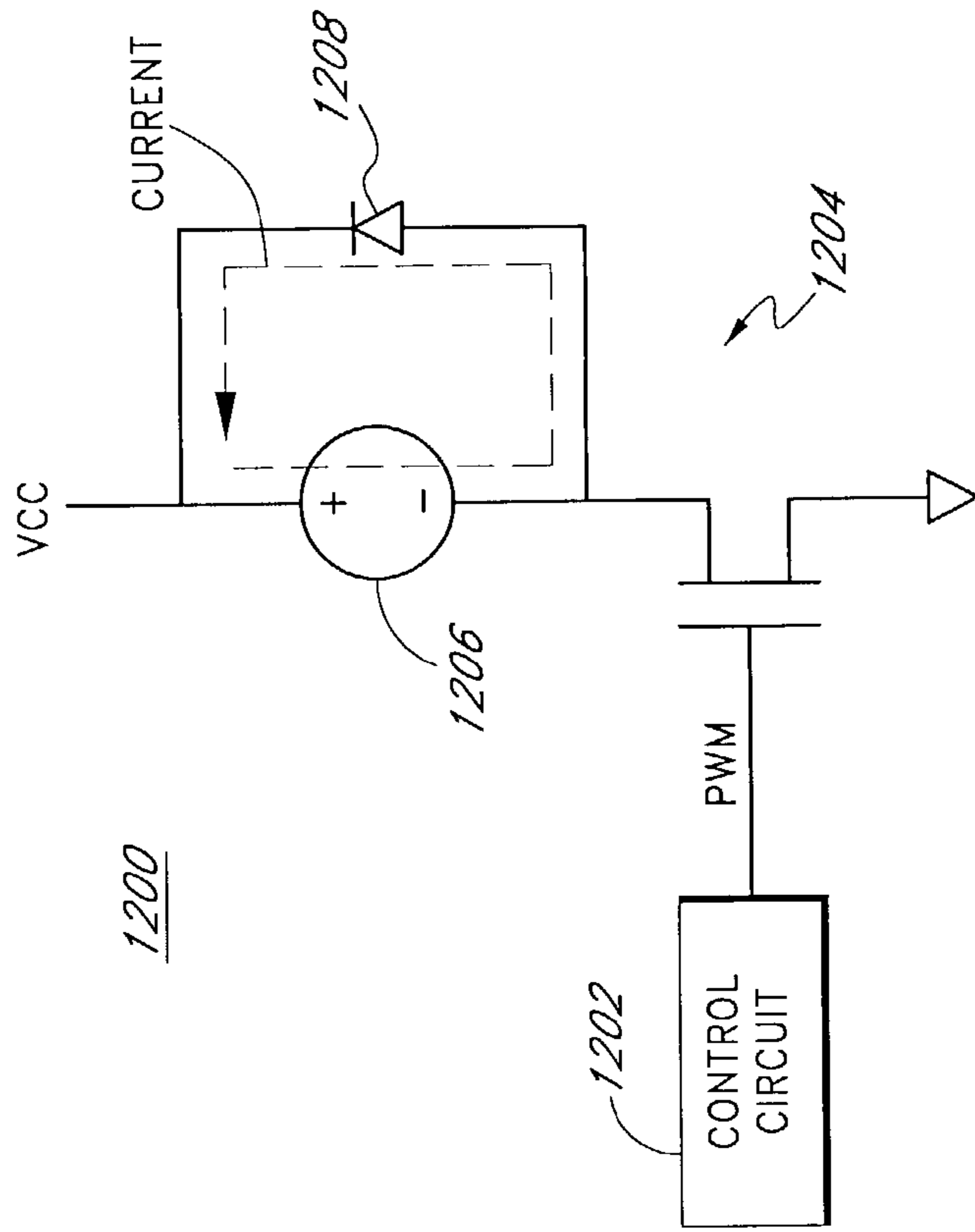


FIG. 12B

OPEN
TRANSISTOR

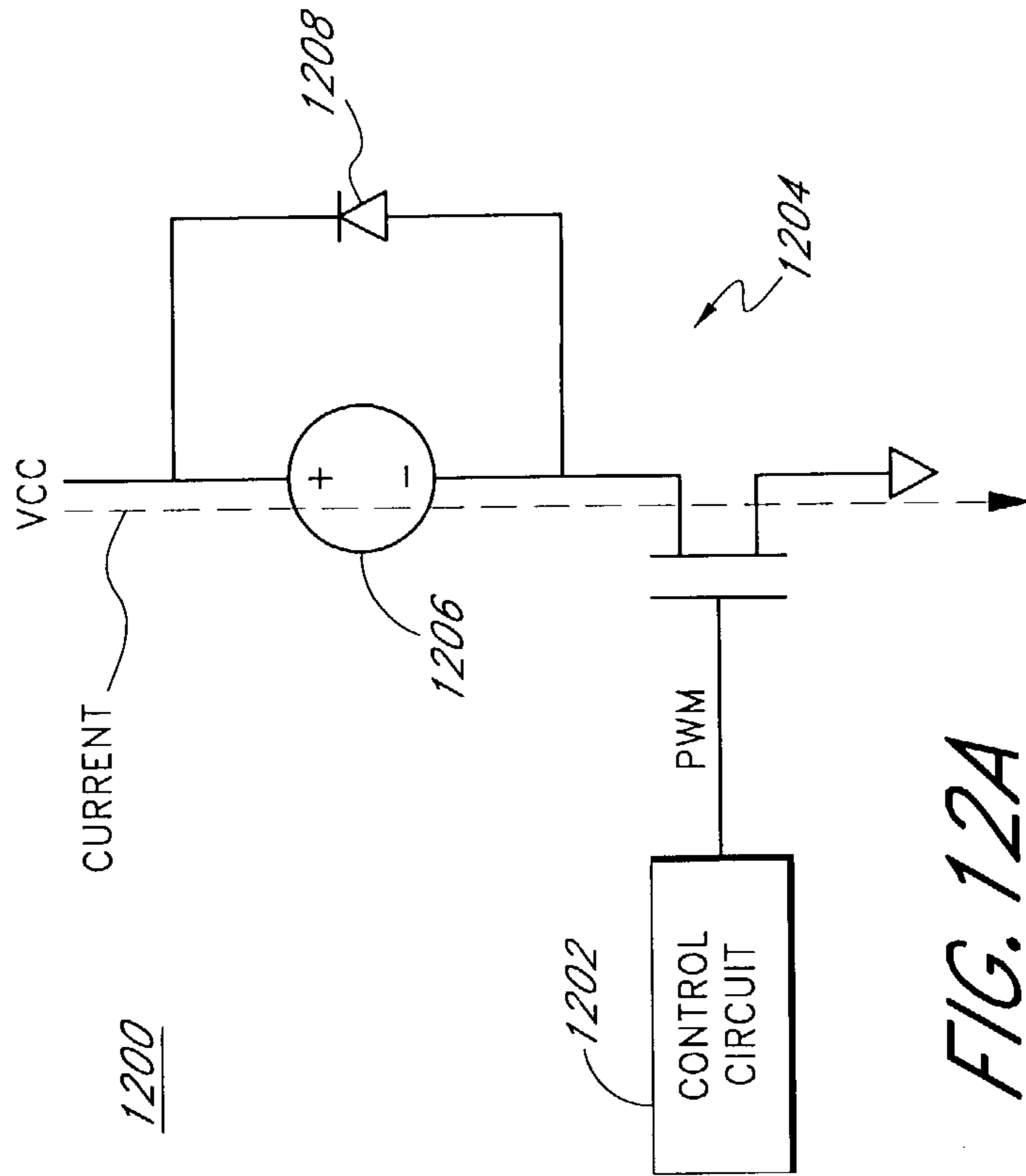


FIG. 12A

CONDUCTING
TRANSISTOR

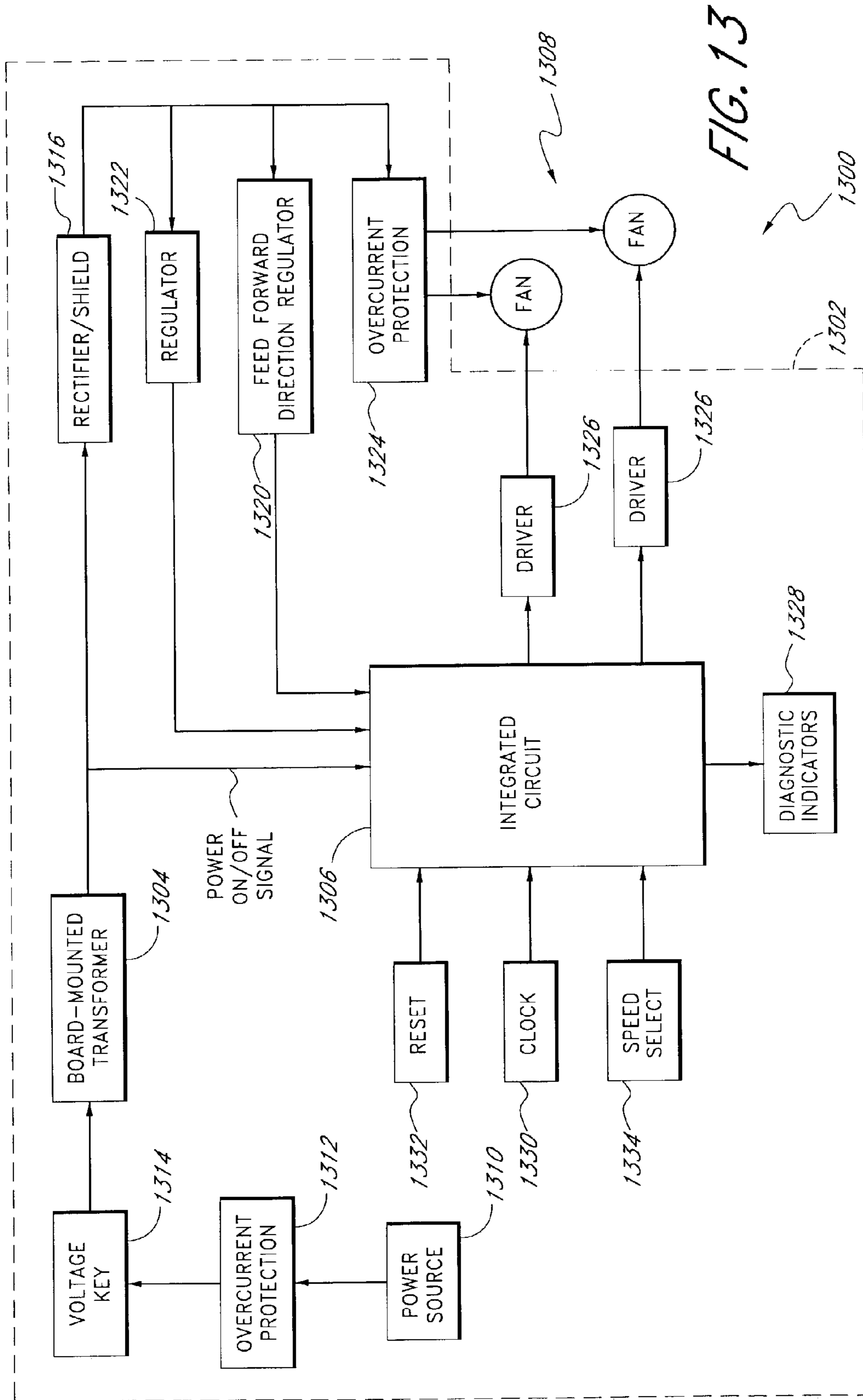
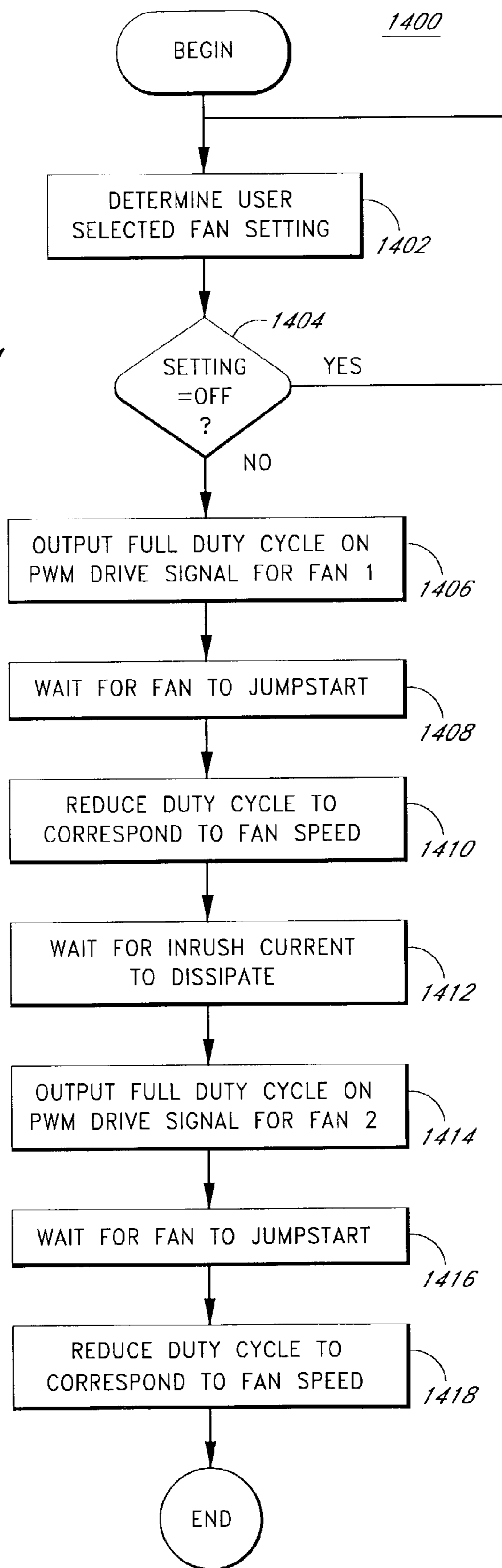


FIG. 14



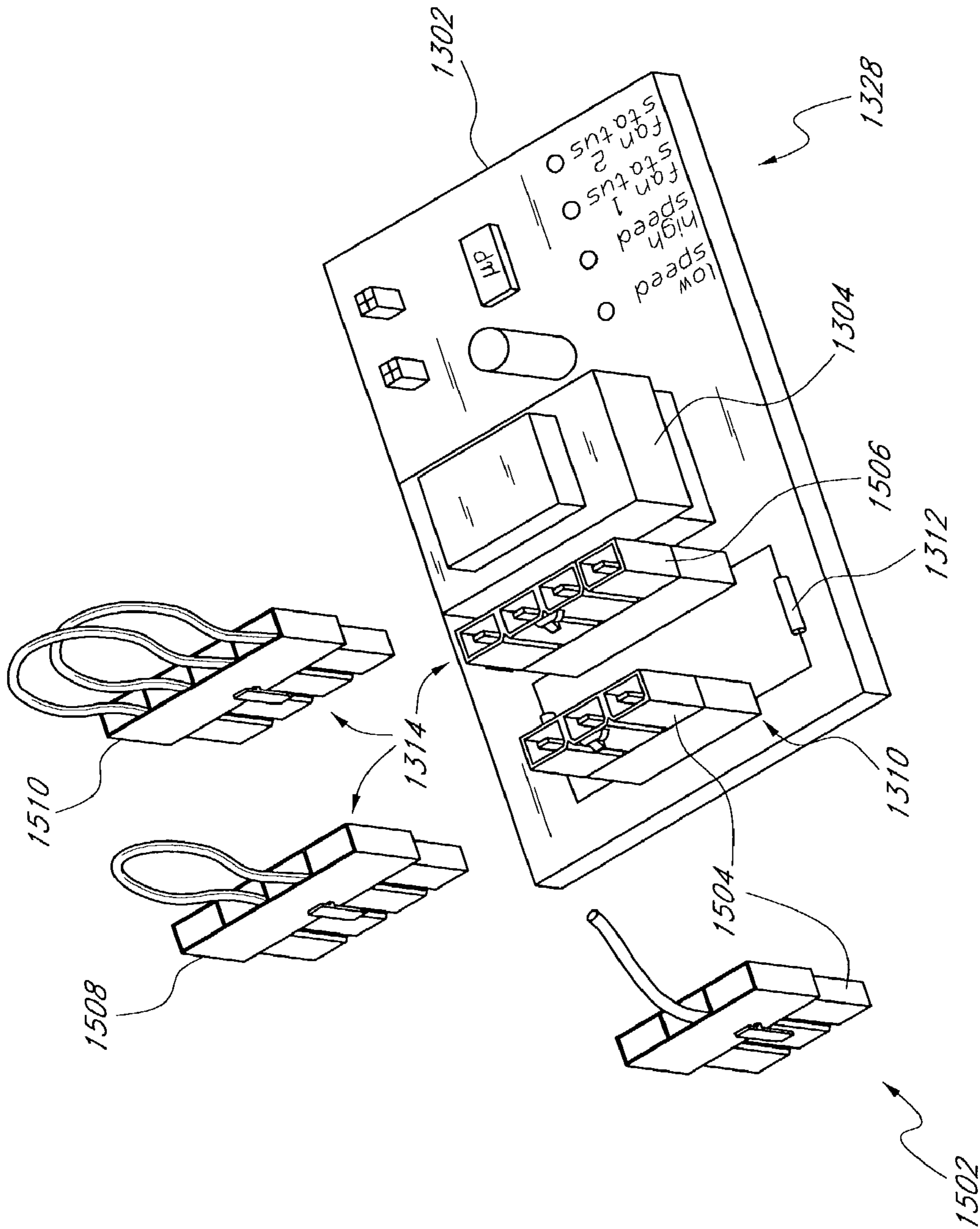
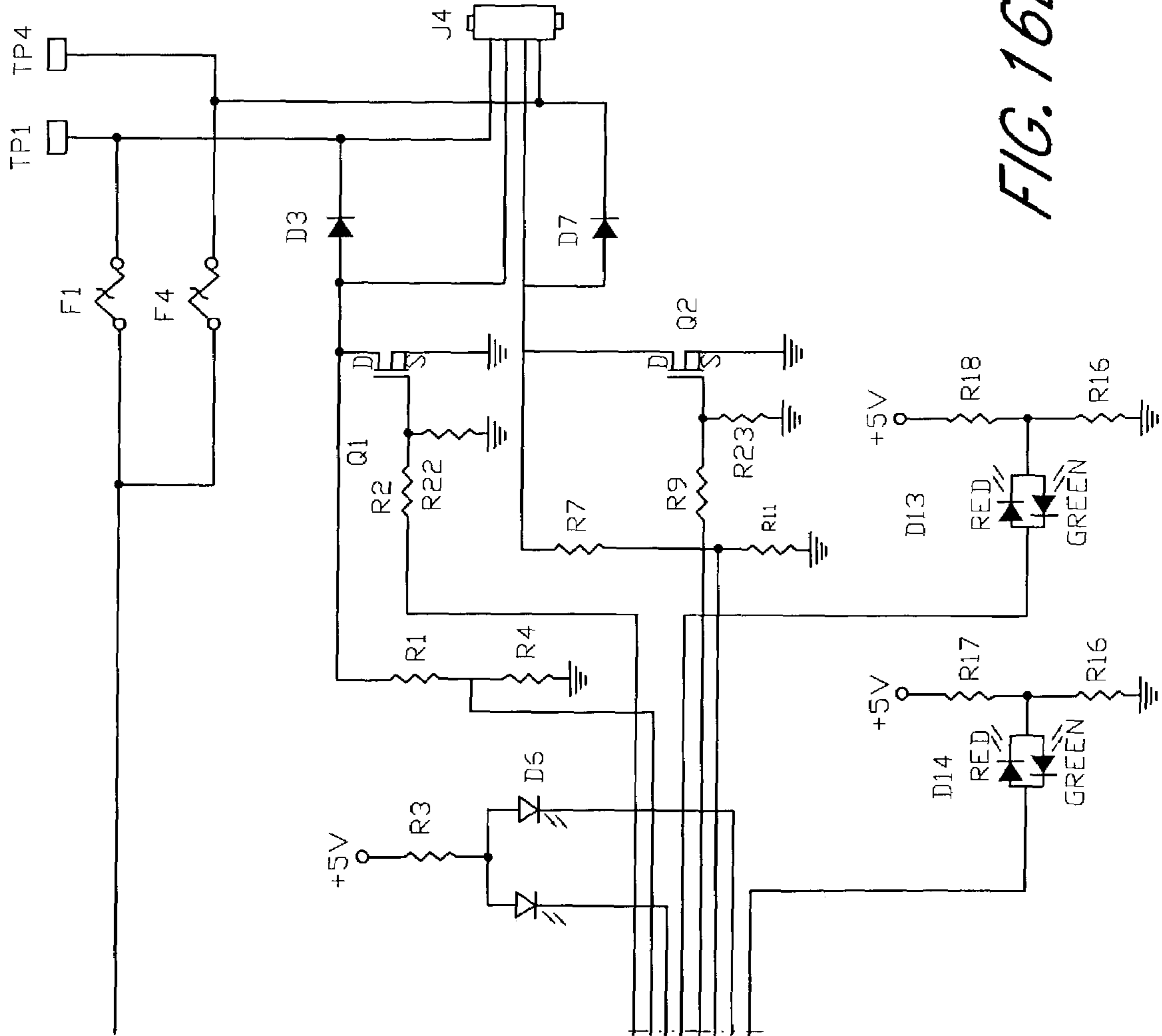


FIG. 15



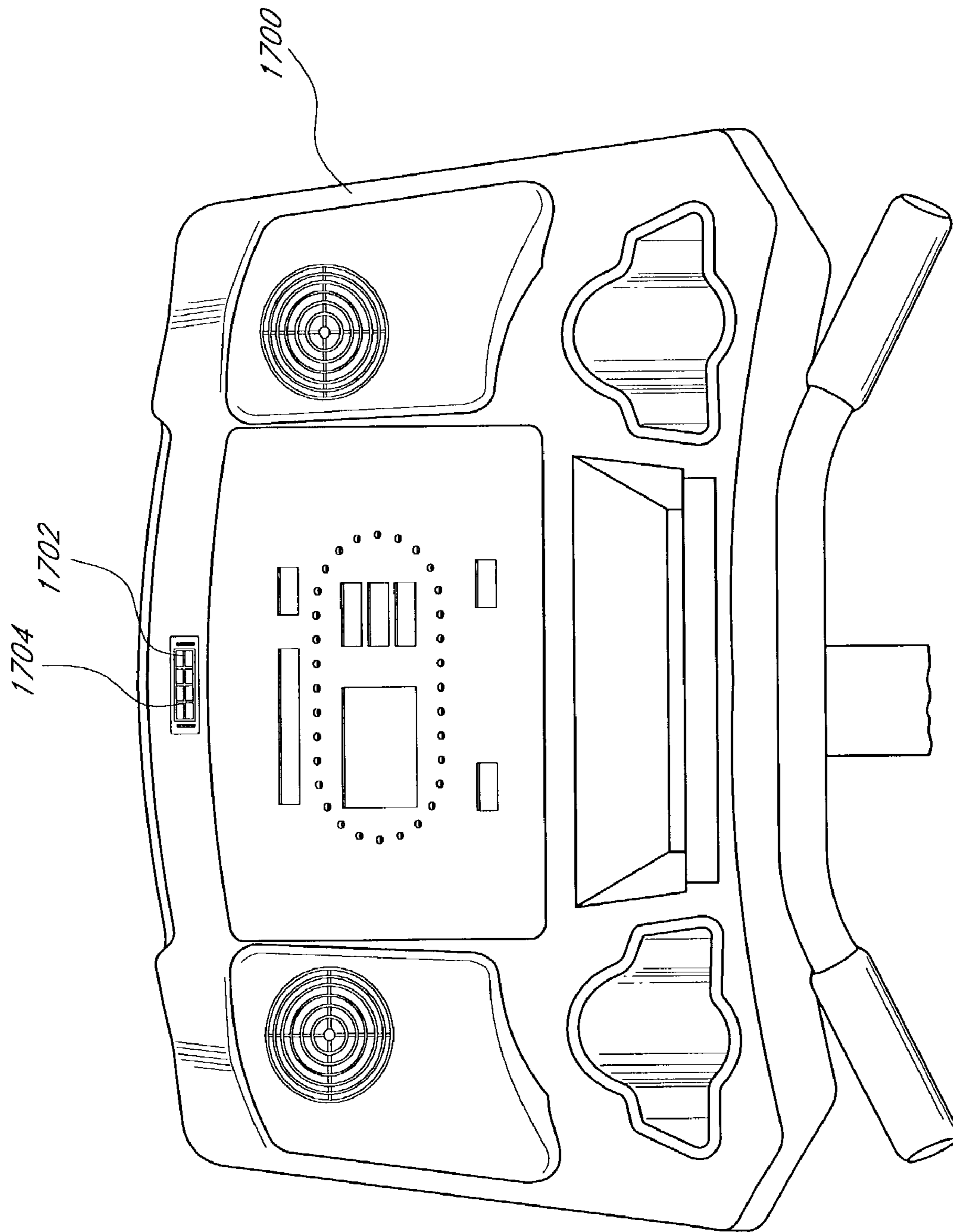


FIG. 17

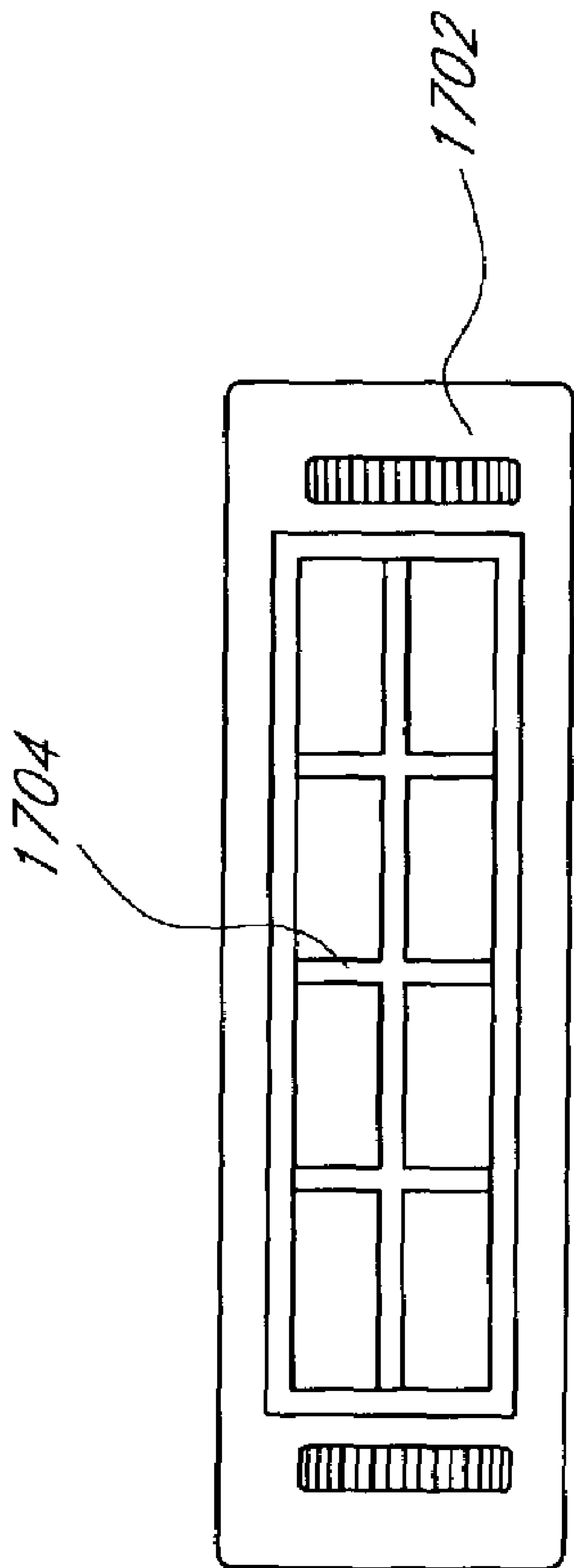


FIG. 18

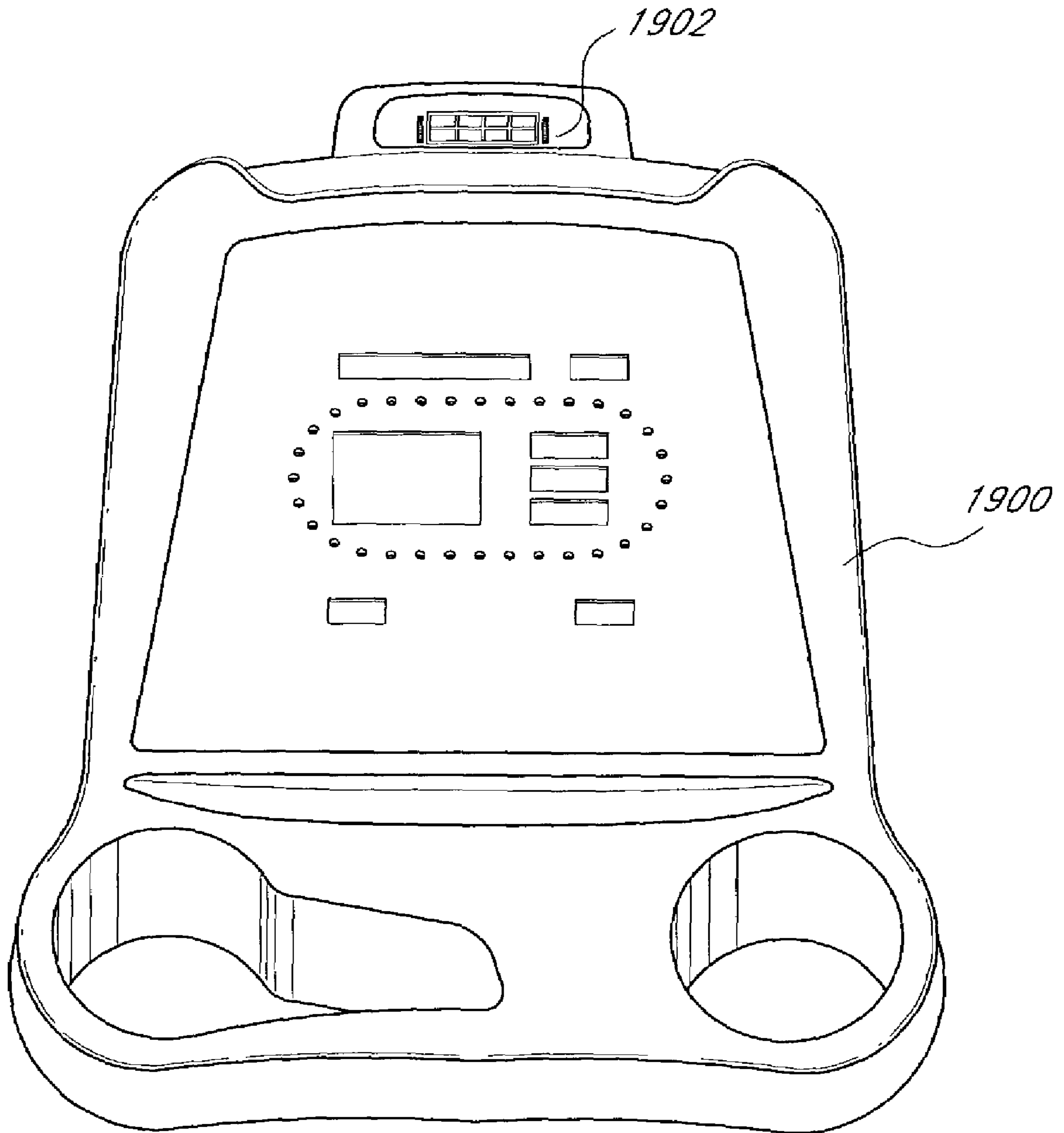


FIG. 19

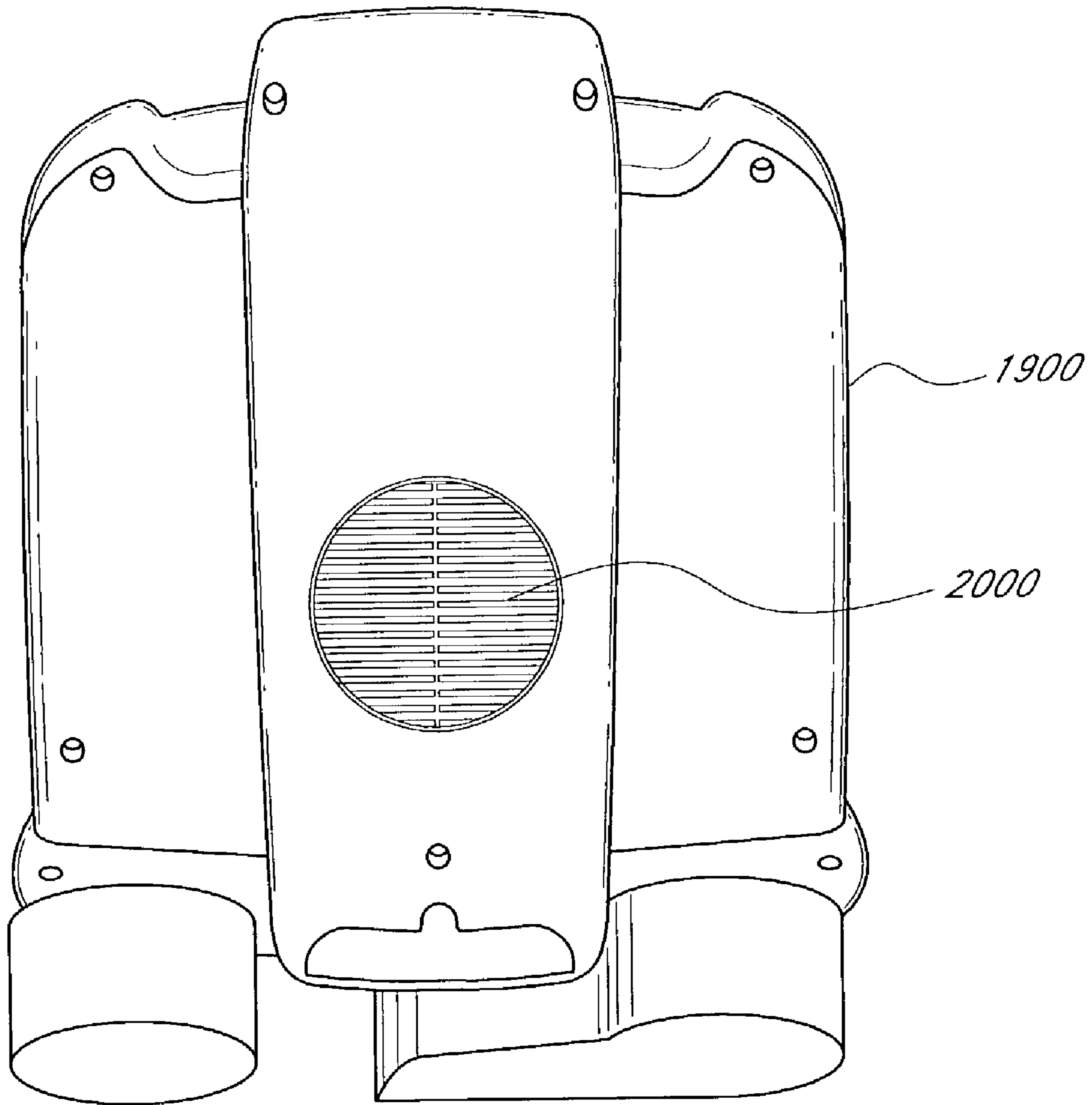


FIG. 20A

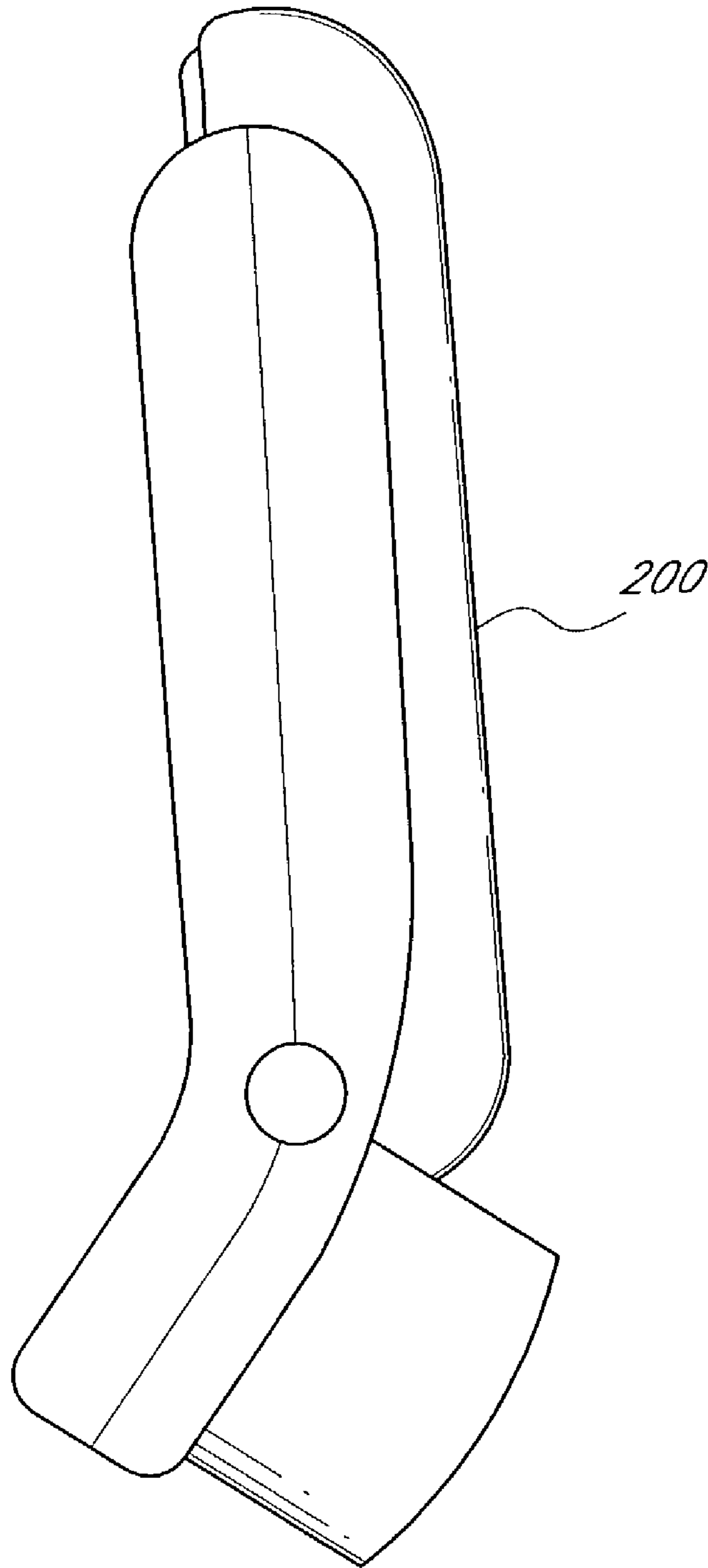


FIG. 20B

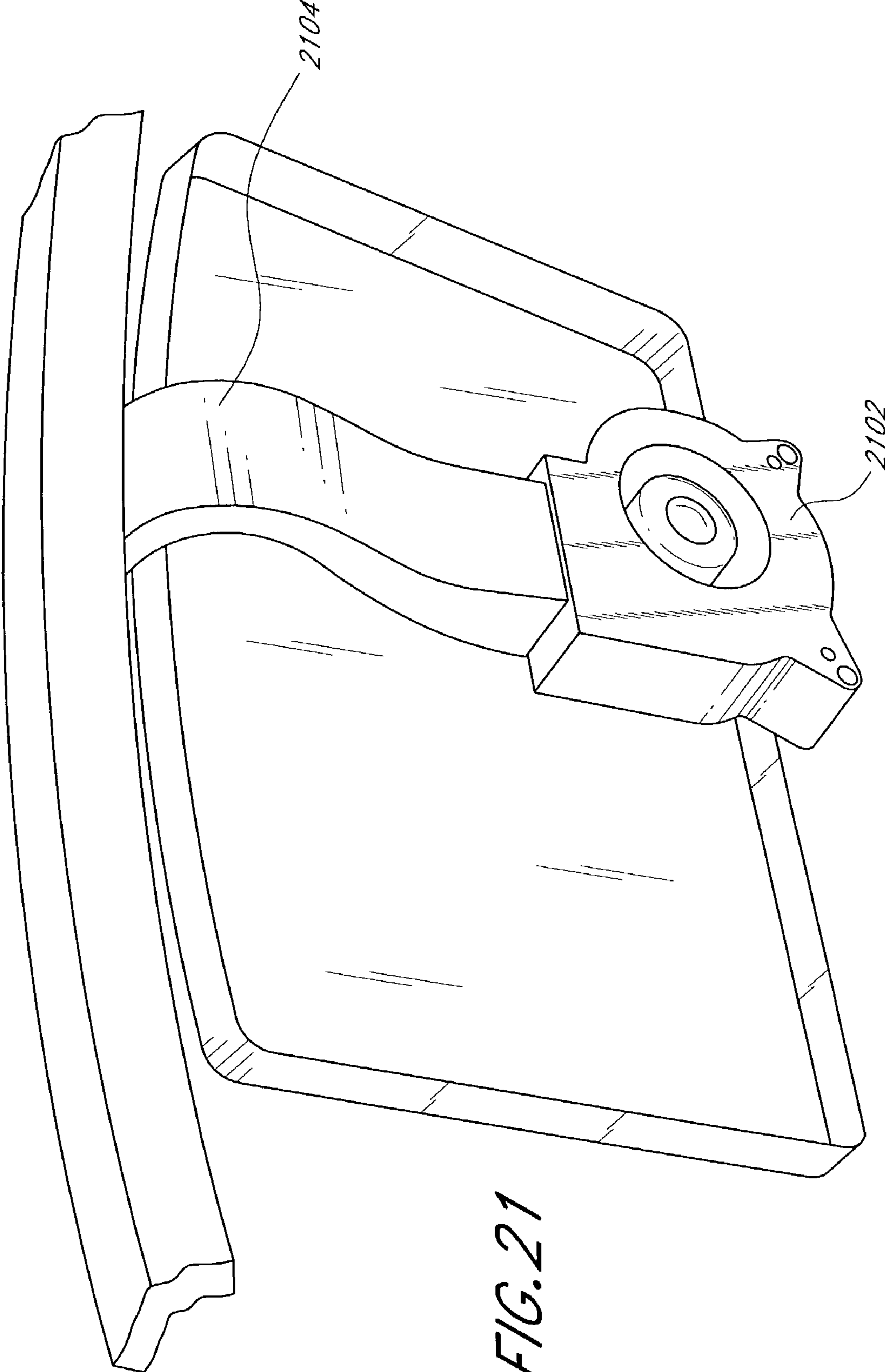


FIG. 21

MAINTENANCE FACILITATING EXERCISE MACHINE CONSOLE

REFERENCE TO RELATED APPLICATION

The present application claims priority benefit under 35 U.S.C. §119(e) from U.S. Provisional Application No. 60/399,336 filed Jul. 26, 2002, entitled "Cooling System For Exercise Machine," which is hereby incorporated by reference in its entirety. The present application is also related to U.S. patent application Ser. No. 10/299,648 filed concurrently herewith, entitled "Control Circuit Using Toggled Activation To Reduce Inrush Currents" and U.S. patent application Ser. No. 10/299,627, filed concurrently herewith, entitled "Cooling System For Exercise Machine," the disclosures of which are hereby incorporated by reference in their entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to control panels for exercise machines. More particularly, the present invention relates a control panel that is mounted in a display console of an exercise machine such that the control panel can be easily removed and replaced during servicing of the exercise machine.

2. Description of the Related Art

Exercise machines are used in many different environments. For instance, some exercise machines are owned by individuals and are used at home. Other exercise machines are owned by businesses, including health clubs and physical therapy specialists. The later group of machines tend to be heavily used.

Among the exercise machines in use at various businesses, some of the more popular machines are so-called cardiovascular machines, such as, for example, stair climbers, stationary bicycles, elliptical trainers, treadmills and the like. Due to the demand for the machines at each business, maintenance can be an inconvenience to both the business and its customers.

SUMMARY OF THE INVENTION

Accordingly, it is desired that the exercise machine be configured for rapid maintenance operations. Among the maintenance operations that can be encountered is a replacement of a display unit. The display unit serves as an interface between the machine and the user. Typically, the installation or removal of a display unit is very complicated due to the many electrical connections as well as the many mechanical connections used to secure the display unit in position.

One aspect of the present invention involves a display console for an exercise machine comprising a housing. The housing defines an opening and a display electronics assembly has an outer perimeter that generally corresponds to the opening. The electronics assembly comprises a keypad panel, a display panel and an electronics panel, with the keypad panel and the display panel abutting each other and the electronics panel being spaced from the keypad panel and the display panel by standoffs. A plurality of fasteners secure the display electronics assembly within the opening and the electronics panel comprise connectors that are adapted to place the display electronics assembly in electrical communication with a power supply and a controller.

Another aspect of the present invention involves a method of removing and replacing a display of an exercise machine.

The method comprises removing at least one threaded fastener from a rear surface of a console, sliding the display forward from a front surface of the console, disconnecting at least one electrical wire from an electrical socket disposed on the display, removing the display from the exercise machine, supplying a replacement display, connecting the wire to an electrical socket disposed on the replacement display, sliding the replacement display rearward toward the front surface of the console and replacing the at least one threaded fastener in the rear surface of the console.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects and advantages of the present invention will now be described with reference to the drawings. The drawings and the associated descriptions are provided to illustrate embodiments of the present invention and not to limit the scope of the invention. Throughout the drawings, reference numbers will be consistently used to indicate corresponding elements in different FIGURES. In addition, the first digit of each reference number may indicate the figure in which the element first appears, particularly in the latter portion of the disclosure.

FIG. 1 is a perspective view of a treadmill taken from the upper, rear, right side, which is arranged and configured in accordance with certain features, aspects and advantages of the present invention.

FIG. 2 is a rear elevation view of the treadmill of FIG. 1.

FIG. 3 is a right side elevation view of the treadmill of FIG. 1, which is substantially a mirror image of the left side elevation view.

FIG. 4 is a front elevation view of the treadmill of FIG. 1.

FIG. 5 is a top plan view of the treadmill of FIG. 1.

FIG. 6 is a bottom plan view of the treadmill of FIG. 1.

FIG. 7 is a user side view of a display console used with a treadmill, such as the treadmill illustrated in FIGS. 1–6, and arranged and configured in accordance with certain features, aspects and advantages of the present invention.

FIG. 8 is an exploded view of the display console showing a user cooling assembly that is integrated into the display console, which is arranged and configured in accordance with certain features, aspects and advantages of the present invention.

FIG. 9A is a section view generally taken along the line A—A in FIG. 7.

FIG. 9B is a section view generally taken along the line B—B in FIG. 7.

FIG. 10 is an exploded view showing a display electronics assembly used with the display console of FIG. 7, which assembly is arranged and configured in accordance with certain features, aspects and advantages of the present invention.

FIG. 11 is an exploded view showing a mounting arrangement used to secure the display electronics assembly of FIG. 10 to the display console of FIG. 7, which arrangement comprises certain features, aspects and advantages of the present invention.

FIG. 12 is a simplified circuit diagram illustrating the use of pulse width modulation to control an electric motor in accordance with certain features, aspects and advantages of the present invention.

FIG. 13 is a block diagram of a fan controller board that has been arranged and configured in accordance with certain features, aspects and advantages of the present invention.

3

FIG. 14 is a flow chart of a powering on process that is arranged and configured in accordance with certain features, aspects and advantages of the present invention.

FIG. 15 is a simplified perspective view of the fan controller board of FIG. 13, which is arranged and configured in accordance with certain features, aspects and advantages of the present invention.

FIG. 16 is a circuit diagram of the fan controller board of FIG. 13, which is arranged and configured in accordance with certain features, aspects and advantages of the present invention.

FIG. 17 is a front view of a display console having an adjustable center opening, which is arranged and configured in accordance with certain features, aspects and advantages of the present invention.

FIG. 18 is a front view of the adjustable center opening of the display console of FIG. 17.

FIG. 19 is a front of a display console having an adjustable center opening, which is arranged and configured in accordance with certain features, aspects and advantages of the present invention.

FIG. 20 is a back and side view of the display console of FIG. 19, illustrating embodiments of front and back panels of the display console, as well as air intake and ducting used in a personal cooling system.

FIG. 21 is a perspective view of the display console of FIG. 19, with the back panel removed to show a squirrel cage fan and ducting for the personal cooling system of FIG. 20.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to FIGS. 1–6, a treadmill 20 that is arranged and configured in accordance with certain features, aspects and advantages of the present invention is illustrated therein. While various features of the present invention have been shown and will be described in the context of the treadmill 20, the present invention also can be used with other forms of exercise apparatus, such as, but not limited to, stair climbers, elliptical exercise machines, stationary bicycles, ski machines and the like.

The treadmill 20 generally comprises a frame assembly 22. The frame assembly 22 can have any suitable configuration. In one arrangement, the frame assembly 22 is formed by a number of tubular members that are secured together by, for instance, welding, brackets and/or fasteners. The frame assembly 22 generally defines a base structure of the treadmill 20.

A support surface 24 is connected to the frame assembly 22. The support surface 24 can be secured to the frame assembly 22 in any suitable manner. The support surface generally defines a planar surface upon which a user is supported when mounting the treadmill 20, when dismounting the treadmill 20 and when exercising on the treadmill 20.

An endless belt 26 extends over the support surface 24. The endless belt 26 is tensioned and driven by a belt drive assembly (not shown). Any suitable belt drive assembly can be used. The belt drive assembly preferably is a motor driven assembly, which comprises a motor 29 (shown schematically in FIG. 3 connected to a shaft 27 driving the belt 26). In some applications, however, the belt drive assembly is not actually driving the belt, but may be turning a generator based upon movement of the belt, which is imparted by the user. In the illustrated arrangement, a motor housing 28 is disposed over a forward portion of the endless belt 26. The motor housing 28 advantageously comprises a contoured

4

surface that faces the user such that the user is less likely to kick the motor housing 28 during use.

The frame assembly 22 can be supported in any suitable manner relative to a floor or other surface. In the illustrated arrangement, the frame assembly 22 is supported by a pair of rollers 30 at a forward end and by a pair of leveling feet 32 at a rearward end. The illustrated arrangement advantageously results in the rollers 30 being placed beneath a majority of the machine weight. In other arrangements, any number of leveling feet or rollers can be used. In yet other arrangements, the frame assembly 22 itself can be constructed with integral components that are supported by the floor or other surface.

In the illustrated arrangement, a support standard 34 extends upward and rearward from a forward side of the motor housing 28. The illustrated standard 34 is connected to the frame assembly 22 at a forward side with treaded fasteners. Other connections also can be used. The standard 34 extends to a console 36 in the illustrated arrangement. As such, in the illustrated arrangement, the standard 34 extends upward and bends rearward to place the console 36 at a location generally rearward of the motor housing 28.

Advantageously, the illustrated standard 34 is a hollow member. Forming the standard 34 of a hollow tubular member decreases the overall weight of the treadmill 20. In addition, the hollow standard 34 can act as a wiring conduit such that wires can pass through the standard 34 between the console 36 and the motor housing 28. In another arrangement, the hollow standard 34 can be used as an air conduit to provide airflow to either the console 36 or to a user of the treadmill 20.

As illustrated in FIG. 1, a railing assembly 38 extends upward and forward from a portion of the frame assembly 22. The railing assembly 38 preferably is connected to a portion of the console 36 and can be connected to the console 36 in a manner that will be described in further detail below.

With reference now to FIG. 6, the railing assembly 38 preferably comprises a pair of handrails 40 (one shown) that extend upward from the frame assembly 22. The handrails 40 can be constructed of any number of components, depending upon the application. In addition, the illustrated handrails 40 extend slightly away from the console 38 while extending upward before turning toward the console 38. Such a construction allows greater breadth in the region commonly used during exercise.

The illustrated handrails 40 preferably are connected at a forward end by a cross-member 42. The cross member 42 can be integrally formed with the handrails 40 in some arrangements. The cross member 42 is exposed at an upper portion of the console 36 in the illustrated arrangement. As such, the cross member 42 defines a grab bar that can be gripped by a user during operation of the treadmill or during data input prior to using the treadmill, for instance. Preferably, this cross member 42 is disposed at about shoulder level or slightly below shoulder level for about 95 percent of the male population. In some arrangements, the cross member 42 can be disposed at about shoulder level or slightly below shoulder level for about 95 percent of the female population. Other heights also can be used depending upon the target user population.

The illustrated railing assembly 38 also comprises at least one handgrip 44 that extends inward from the handrails 40. Preferably, the handgrip 44 extends between the handrails 40 at a location between the user and the console 38. In some arrangements, the handgrip 44 can comprise sensors 46 to detect user pulse rates and the like. The illustrated handgrip

44 is positioned such that a user can easily grasp the handgrip 44 during operation of the treadmill. In one arrangement, the handgrip is at or above the waist level for about 95 percent of the female population. In another arrangement, the handgrip can be at or above the waist level for about 95 percent of the male population. Other heights can be used and the handgrip could be adjustable in height in some applications.

With reference now to FIGS. 2 and 6, the console 36 will be described in greater detail. In general, the console 36 preferably is formed of a group of suitable plastic moldings. In the illustrated arrangement, an outer shell of the console 36 generally comprises a front piece 50 and a rear piece 52. While additional outer pieces can be used, reducing the number of pieces in the illustrated arrangement advantageously reduces manufacturing costs.

The two pieces 50, 52 can be attached together in any suitable manner. To ease disassembly for maintenance and the like, the two pieces 50, 52 preferably are attached using removable fasteners or mechanical interlocking components. Any such attachment arrangements can be used.

Moreover, in the illustrated arrangement, the console 36 is advantageously connected to the railing assembly 38 by capturing a portion of the railing assembly 38 between the two pieces 50, 52. More specifically, the illustrated cross member 42 is captured between the two pieces 50, 52 within a channel defined by pegs, fastener anchors or the like. Such an arrangement increases the support for the display while reducing the number of pieces used in assembling the exercise machine. Hence manufacturing and maintenance costs can be reduced.

In the illustrated arrangement, the console 36 preferably is slightly concave on the face directed toward the user. As such, the console 36 advantageously comprises a center section 54 and a pair of side wing portions 56 with the center section 54 being recessed away from the user. The side wing portions 56 are provided on separate sides of a generally longitudinally extending center plane CP. The side wings 56 preferably are angled relative to the center section 54 such that an included angle of between about 5° and about 25° is defined between the center section 54 and the side wings 56. In one arrangement, the included angle is between about 10° and about 15°. In a particularly preferred arrangement, the included angle is about 10°.

In addition, the illustrated console face is angled relative to a generally vertical transverse plane V in the illustrated arrangement. In one arrangement, this angle is between about 15° and about 45°. In another arrangement, this angle is between about 20° and about 40°. In one particularly advantageous arrangement, this angle is about 30°. In some arrangements, the console 36 generally is disposed between the waist level of about 95 percent of the female population and the head level of about 95 percent of the male population. Other heights also can be used depending upon the application.

With reference now to FIG. 1, the console 36 also comprises an elongated accessory holder 60. In the illustrated arrangement, the accessory holder 60 is integrally formed with the center section 54. The accessory holder 60 preferably comprises a recessed pocket that is sized as desired. In one arrangement, the accessory holder 60 has a length such that a book or magazine can be easily held within the accessory holder 60. Accordingly, in such an arrangement, the accessory holder 60 can have a length between about 8" and about 14". In one preferred arrangement, the accessory holder has a length of about 9.7".

Preferably, the accessory holder 60 has a slightly angled front lip 62 relative to a rear wall 64 of the accessory holder 60.

With continued reference to FIG. 1 and with additional reference to FIG. 5, a pair of smaller accessory holders 70 are disposed to the sides of the accessory holder 60. The smaller accessory holders 70 preferably are positioned on the side wings 56. In one arrangement, the smaller accessory holders 70 are shaped to accept a variety of items having differing cross-sectional profiles. For instance, with references to FIG. 5, the accessory holders 70 comprise a rounded generally cylindrical portion 72 and a slot portion 74 that intersect. As such, the illustrated accessory holders 70 can accept rounded articles (e.g., cans, bottles, etc.) and more square articles (e.g., personal data assistants, wallets, cellular telephones, etc.). In one particularly preferred arrangement, data transfer ports and power ports can be provided in the accessory holders 60, 70 such that a personal data assistant, cellular phone or the like can be plugged into the data port, allowing for transfer of data between the personal data assistant and a control unit of the exercise machine or other electronic component (e.g., to provide streaming audio, video, interactive information or the like) or to allowing charging of such electrical devices.

It should be noted that while the adjective smaller is used with respect to the illustrated accessory holders 70, this term should not suggest that these accessory holders 70 must be smaller than another accessory holder. Any relative sizing of the accessory holders can be used as desired.

The illustrated console 36 preferably also comprises one or more information display arrangements 76. The information display arrangements 76 can take any suitable configuration. For instance, in some arrangements, the information display arrangement 76 can include light bars (e.g., LED lamps in a line). In other arrangements, the information display arrangement 76 can include a display screen (e.g., a liquid crystal panel or the like). The information display arrangement can be used to form a portion of a user interface. The user interface allows a user to input information and to receive information. Many such interfaces are well known.

With reference now to FIG. 2, the illustrated treadmill 20 advantageously comprises an integrated user cooling system 80. The cooling system 80 comprises at least one fan assembly 82 that is mounted to the treadmill at a location above the base structure of the treadmill (e.g., at the console 36). By positioning the fan assembly 82 at a location above the base structure of the treadmill, the fan assembly 82 is closer to the head and upper body region of a user. Such a location decreases the flow rate of air that needs to be achieved in order for adequate cooling to be achieved.

In the illustrated arrangement, two fan assemblies 82 are provided, with one fan assembly 82 being mounted in each of the side wing portions 56. As described above, the illustrated console 36 is advantageously angled such that the height and the angles result in a straight airflow vector AF toward a user's upper body and/or head region. Other consoles designs (e.g., differing heights and/or angles) can be used and the fans can be angled relative to the console accordingly. The illustrated arrangement, however, has been designed for a unique appearance while maintaining a suitable relationship between the fans and the user.

The fan assembly 82 generally comprises a blower or fan 84 that preferably is electrically connected to a power source of the exercise machine through a controller circuit as disclosed with reference to FIGS. 12–16. Alternatively, the fan 84 can be connected to a power supply that is fed by a

power cord **85** used to supply power to the control system or motor of the treadmill. In other arrangements, if the treadmill **20** comprises a generator, the fan **84** can be driven by electrical power supplied by the generator. Such electrical connections reduce the number of plugs that must be accommodated by a gym or home for use of the machine.

The fan **84** can be any suitable type of fan (e.g., tube axial fan, centrifugal fan, vane axial fan). In the illustrated arrangement, a tube axial fan is used. With reference to FIG. **9A**, the fan **84** preferably is encased within the console **36**. More preferably, the fan **84** is positioned within ducting **86** in a manner that reduces or eliminates airflow through a cavity defined within the console **36** outside of the ducting **86**. In the illustrated arrangement, the ducting **86** comprises a rubber duct section **87** and the housing of the tube axial fan. In this arrangement, a portion of the ducting **86** also comprises a portion **89** of one of the pieces **50**, **52** of the outer shell of the console. Other suitable ducting arrangements can be used. Advantageously, the fan **84** is disposed between a portion of the rear piece **52** of the console **36** and the ducting **86** and the two components can be used to support the fan **84** such that assembly and maintenance can be simplified. In one alternative arrangement, the fan **84** and the ducting **86** can be unitarily formed such that fewer components are used in the construction of the cooling system **80**.

The ducting **86** advantageously extends between a user surface **88** of the console **36** (i.e., a surface that faces the user during operation) and another surface that does not face the user during operation. In one advantageous arrangement, the ducting **86** extends straight through the console **36** between the user surface **88** and a back surface **90**. In another arrangement, the ducting **86** is bent such that the ducting **86** extends between the user surface and a side surface of the console **36**. Preferably, an inlet to the fan assembly **82** and an outlet to the fan assembly are positioned to reduce recirculation of air from the outlet to the inlet. In the illustrated arrangement, such a recirculating restriction is achieved by positioning the inlet **92** on the back surface **90** and the outlet **94** on the user surface **88**.

Preferably, both the inlet **92** and the outlet **94** are covered by respective grills **96**, **98**. In some arrangements, the outlet **94** can be covered by a flow directing assembly or component, such as louvers or the like. By properly angling the surfaces of the console **36** about the outlet **94**, the angling of the airflow is simply achieved. In some arrangements, a nozzle or gimbal arrangement can be used to further enhance directional control. In the illustrated arrangement, the angle of the ducting and the restriction defined by the ducting **86** are used to direct a focused stream of air toward an upper portion of a user's body when positioned for use on the illustrated treadmill.

With reference now to FIGS. **10** and **11**, a display electronics assembly **100** is illustrated in simplified form. This assembly **100** is one presently preferred construction of at least a portion of the display arrangement **76**. The illustrated display electronics assembly **100** generally comprises a keypad panel **102**, a display panel **104** and an electronics panel **106**. The three panels **102**, **104**, **106** are placed together in a suitable manner. In the illustrated arrangement, the keypad panel **102** and the display panel **104** generally abut each other while the display panel **104** is offset from the electronics panel **106** by standoffs **108**. Such an arrangement facilitates cooling of the electronics panel **106**. Threaded fasteners **110** or other suitable connection mechanisms can be used to secure the panels **102**–**106** together.

The electronics panel **106** preferably comprises connectors used to supply power and used to transfer information between the display electronics assembly **100** and a controller of the treadmill **20**. Suitable electrical conduits (e.g., wires and connectors) can be used to place the electronics panel **106** in electrical communication with the controller. In some arrangements, infrared or other arrangements (e.g., not hard-wired connections) can be used.

Advantageously, the display electronics assembly **100** can be fitted to and removed from the console **38** by simply removing a fastening assembly and unplugging any wires that connect the display electronics assembly **100** to the controller. In the illustrated arrangement, the display electronics assembly **100** is secured in position using standoffs **114** and threaded fasteners **116**. Other mechanical connection arrangements can be used. The illustrated arrangement, however, advantageously simplifies replacement of a faulty display assembly **100** and eases maintenance.

With reference now to FIGS. **12**–**16**, a control circuit **1202**, such as, for example, a fan controller board **1300**, which is arranged and configured in accordance with certain features, aspects and advantages of the present invention is illustrated therein. While various features of the present invention have been shown and will be described in the context of the control circuit **1202** for use with the foregoing treadmill **20**, the present invention also can be used with other forms of exercise apparatus, such as, but not limited to, stair climbers, elliptical exercise machines, stationary bicycles, ski machines and the like.

FIGS. **12A**–**12B** illustrate a simplified circuit diagram **1200** comprising a control circuit **1202**, a transistor **1204**, an electric motor **1206**, and a flyback diode **1208**. As shown in FIGS. **12A**–**12B**, the control circuit **1202** outputs a pulse width modulated (PWM) drive signal to switch the transistor **1204** on and off (conducting and open), thereby effectively toggling the activation of current through the circuit. The control circuit **1202** turns on the current by switching the transistor **1204** to a conducting circuit for a brief instant, defined by the duty cycle of the PWM drive signal, as shown in FIG. **12A**. Each instant can be less than the time it takes for the current through the motor to reach its peak inrush current, then the controller circuit **1202** shuts the current off by switching the transistor **1204** to an open circuit. Since the motor **1206** cannot stop instantaneously, the flyback diode **1208** allows the current to keep flowing, as shown in FIG. **12B**. Before the current dissipates, the next pulse turns current back on and gives the motor **1206** another boost. The more the current is conducting, or the greater the duty cycle of the PWM drive signal, the more energy the motor **1206** receives and the faster it turns. Accordingly, through the use of the PWM drive signal, the control circuit **1202** effectively and efficiently controls the inrush current as well as the steady state speed of the fan.

FIG. **13** is a block diagram of an embodiment of the control circuit **1202** of FIG. **12**, where the control circuit **1202** comprises a fan controller board **1300**. As shown in FIG. **13**, according to one embodiment, the fan controller board **1300** advantageously comprises a printed circuit board (PCB) **1302** having a board mounted transformer **1304** supplying power to an integrated circuit **1306**, which in turn provides an output drive signal to one or more fans **1308**, as will be described.

As shown in FIG. **13**, the board **1300** preferably receives power from the power source **1310**. In one arrangement, the power source **1310** may comprise 110 volt or 220 volt AC power, such as that available in commercial and residential buildings. The board **1300** can be protected from abnormal

behavior in the power source **1310** by an overcurrent protection **1312**. According to one embodiment, the overcurrent protection **1312** comprises normal or self-resetting fuses that interrupt current above the tolerances of the board **1300**.

Advantageously, a voltage key **1314** configures the application of power from the power source **1310** to the board mounted step down transformer **1304** to provide isolation and to lower incoming line voltage. For example, the voltage key **1314** preferably configures the wiring through primary windings of the transformer **1304** differently depending upon whether the power source **1310** comprises 110 or 220 volts, as discussed below with reference to FIG. **15**. According to one embodiment, the transformer **1304** is of sufficiently light weight that its mounting will not cause the PCB **1302** to deflect, potentially causing open or short circuit conditions because of brittle or broken traces. Moreover, the transformer **1304** includes characteristics voiding the need for special isolation chambers, electromagnetic interference (EMI) shields, or the like. For example, according to one embodiment, the transformer **1304** meets regulations required for devices used in residential buildings, such as, for example, a Class B transformer such as those commercially available from MCI Transformer Corporation of Willets, Calif., or the like. Because a transformer meeting the foregoing recitations is preferred, the transformer **1304** may have tolerance levels near or below that specified for driving the one or more fans **1308** of the personal cooling system of the exercise machine.

In the illustrated arrangement, the output of the transformer **1304** is supplied to the integrated circuit **1306** and a rectifier/EMI shield **1316**. The integrated circuit **1306** advantageously comprises one or more of a microprocessor, EEPROM, logic gates, ROM, RAM, flash memory, dedicated controllers, combinations of the same, or the like. The integrated circuit **1306** receives inputs from the user and various components of the board **1300**. The integrated circuit **1306** also generates outputs to drive the one or more fans **1308** of the personal cooling system. The integrated circuit **1306** also can activate or change the color of one or more diagnostic indicators or fan speed indicators, as will be discussed with reference to FIGS. **14–16**. According to one embodiment, the integrated circuit **1306** comprises a Motorola PIC16C711-04 integrated circuit, which includes control logic and/or program instructions for accepting the inputs and generating the appropriate outputs, as discussed herein.

As shown in FIG. **13**, the output of the illustrated transformer **1304** is supplied to the integrated circuit **1306**, which uses the output to determine whether power is being continually supplied to the board **1300**. Also, the rectifier/EMI shield **1316** converts the low AC voltage from the illustrated transformer **1304** to unregulated DC voltage and provides a shield against EMI.

As shown in FIG. **13**, the unregulated DC voltage output from the rectifier/EMI shield **1316** is used to power the one or more fans **1308**, as an input to a feed forward direction regulator **1320**, and as an input to the DC power regulator **1322**, whose output is used to power the illustrated integrated circuit **1306**. In one arrangement, the direction regulator **1320** provides a signal to the integrated circuit **1306** indicating whether the unregulated DC voltage is likely to cause the fans **1306** to run backward, fail to start, or the like. In another arrangement, the direction regulator **1320** comprises one or more resistor values providing a predetermined voltage to the integrated circuit **1306** used to determine whether voltage polarity is correct.

As disclosed, the unregulated DC voltage output from the rectifier/EMI shield **1316** also can be used to power the one or more fans **1308**. Before powering the fans **1308**, the unregulated voltage passes through resettable overcurrent protection **1324**. In one arrangement, the protection **1324** includes one or more resettable fuses, such as, for example, one or more polyswitches, which generally protect the circuit from the fans **1308** drawing more current than can be tolerated by the transformer **1304**.

In one arrangement, the fans **1308** comprise DC brushless motor fans, such as those commercially available from Delta Electronics. However, AC motor fans, other brush or brushless fans, squirrel cage fans, combinations of the same, or the like can be used to move air to the user.

FIG. **13** also shows the integrated circuit **1306** producing the PWM drive signals, which are forwarded through drivers **1326** to the fans **1308**. The drivers **1326** may comprise resistors designed to show voltage levels desired by switching transistors, such as those disclosed with reference to FIG. **12**, other switching mechanisms, or the like. The integrated circuit **1306** also outputs a signal or signals to one or more diagnostic indicators **1328**. According to one embodiment where the diagnostic indicators **1328** comprises LEDs and multi-colored LEDs, the signal or signals cause the LEDs to energize or change color when certain diagnostic conditions occur. For example, when a user of the exercise machine activates the personal cooling system, the user may select between settings for the speed of the fans **1308**. In one embodiment, the diagnostic indicators **1328** may indicate the selected speed. Moreover, the diagnostic indicators **1328** can indicate when the direction regulator **1320** has detected an invalid polarity in the DC voltage, or when one or more of the fans **1308** malfunctions.

The integrated circuit **1306** also accepts a clock input **1330**, internal or external resets **1332**, and a speed select **1534** indicating a user-selected speed setting of the fans **1308**. According to one embodiment, the clock input **1330** comprises a 4 MHz clock signal. The reset **1332** can include a power up internal reset used to reset the integrated circuit **1306** when power is first applied to the board **1300**, a manual reset available to the user by, for example, the console **36**, the information display arrangements **76**, a maintenance switch or button on the PCB **1302** itself, combinations of the same or the like.

The speed select **1334** may advantageously be user selected by, for example, one or more switches, buttons, knobs, touch screen, keyboards, or other input mechanism from the console **36** or information display arrangements **76**. For example, the integrated circuit **1306** may receive one or more bits of data indicating the desired speed of the fans of the personal cooling system. For example, one embodiment may include the speed-indicating truth table of Table 1.

TABLE 1

BIT 1	BIT 0	RESULT
0	0	OFF
0	1	LOW
1	0	HIGH
1	1	OFF

FIG. **13** also shows the drivers **1326** and the over current protection **1324** being electrically connected to the fans **1308**, which may be remotely located from the PCB **1302**. For example, according to one embodiment, the PCB **1302** advantageously installs in the motor housing **28** near a motor controller board (not shown). The PCB **1302** is then con-

11

nected to, for example, the fans **1308** located in the console **36**, a user input mechanism such as the information display arrangements **76**, or the like, through, for example, wiring in the standard **34**. Such design allows for straightforward maintenance as the controller board **1300** can advantageously be accessed, for example, near the motor control board of the treadmill.

Based on the foregoing disclosure, the fan controller board **1300** advantageously powers the fans **1308** through use of the integrated circuit **1306**. Such use provides for future adaptability in that a change to, for example, the fans **1308**, may affect only a need for revised software instructions or logic in the microprocessor **1306**. Moreover, the voltage key, which allows the control circuit to be powered by varied power supplies, provides ease of adaptability in differing power supply systems.

FIG. **14** is a flow chart of an exemplary powering on process **1400**, used to power on the presently preferred fans **1308** without exceeding the tolerance levels of the presently preferred transformer **1304**. As shown in FIG. **14**, the process **1400** includes block **1402** where the integrated circuit **1306** determines the user-selected fan setting. As disclosed in the foregoing, the speed may include an actual speed of rotation, an airflow measurement, comparative flow levels like “LOW,” “HIGH,” “SLOW,” “FAST,” “FASTER,” “FASTEST,” combinations of the same, or the like. According to one embodiment, the user selects the setting for his or her personal cooling system as “OFF,” “LOW,” and “HIGH,” from, for example, the console **36** or one of the information display arrangements **76**. The integrated circuit **1306** receives the user selection, and at block **1404**, the integrated circuit **1306** determines whether the user has selected “LOW” or “HIGH.” When the user has selected neither and desires the personal cooling system to be off, the process **1400** returns to block **1402**. When the user has select “LOW” or “HIGH,” the integrated circuit **1306**, at block **1406**, outputs the PWM drive signal at full duty cycle to the first of the fans **1308**. According to one embodiment, the integrated circuit **1306** may synchronize the PWM drive signal to the AC power from the power source **1310**, such as, for example, using a PWM drive signal of 60 or 50 Hz. The integrated circuit **1306** then waits for the fans **1308** to be jumpstarted by the heavy duty cycle. According to one embodiment, the integrated circuit **1306** waits approximately 200 ms,

After the jumpstart, the integrated circuit **1306** reduces the duty cycle to correspond with the user selected fan speed. For example, according to one embodiment, a “LOW” speed setting corresponds to around a forty percent (40%) duty cycle, while a “HIGH” speed setting corresponds to around an eighty percent (80%) duty cycle. According to another embodiment, the “LOW” speed setting can range between about 30% and about 50% duty cycle and the “HIGH” speed setting corresponds can range between about 70% and about 90% duty cycle. In addition, the “FULL” duty cycle used to jumpstart the fans can correspond to about a one hundred percent (100%) duty cycle. However, a lower percentage duty cycle can be used to jumpstart the fans. The duty cycle also may vary based on the fan design specifications and manufacturer, may include one, two, or more speed settings, settings for each fan, combinations of the same or the like.

Because the duty cycle of the PWM drive signal is generated by the integrated circuit **1306**, the entire board **1300** is advantageously very modular in design. For example, were a design change made to the personal cooling system such that a different fan is used in the system, such

12

as, for example, a squirrel cage fan or a fan by a different manufacturer, an entire redesign of the control circuit is not needed. Rather, a straightforward update to the software and/or logic of the integrated circuit **1306** can accomplish the change, such as, for example, an update associating new duty cycles of the PWM drive signal with the user selected speed settings. In one embodiment, such an update will account for the inrush current of the newly used fans, a desired cooling effect determined by a user or the like.

After reducing the duty cycle, the integrated circuit **1306** at block **1412** waits for the inrush current associated with powering on the first fan to dissipate to a point where another inrush current for jumpstarting another fan, added to the current being used by any already running fans, still does not exceed the tolerances of the transformer **1304**. According to one embodiment, the wait takes into account the greatest current draw, for example, the duty cycle of around 80%, and waits approximately 2.5 s, however, the delay can vary to meet any number of operational or other desired parameters. Thereafter, in steps **1414–1418**, the integrated circuit **1306** jumpstarts the next fan and reduces its duty cycle to the steady state.

Although the powering on process **1400** is disclosed with reference to its preferred embodiment, the invention is not intended to be limited thereby. Rather, a wide number of alternatives can be used for powering on the fans **1308** without exceeding the tolerances of the board **1300**. For example, the integrated circuit **1306** may interleave the powering on the of the fans, power the fans up as soon as there is sufficient current, use delays specifically associated with each user selected speed setting of each fan, combinations of the same, or the like. Two such examples illustrating potential steps of exemplary duty cycles being powered on are shown in Table 2.

TABLE 2

EXAMPLE 1		EXAMPLE 2	
FAN 1	FAN 2	FAN 1	FAN 2
1 30%	2 30%	1 30%	
3 50%	4 50%	2 50%	
5 70%	6 70%	3 70%	4 30%
7 80%	8 80%	5 80%	6 50%
			7 70%
			8 80%

As disclosed in the foregoing, use of the integrated circuit **1306** advantageously allows for a wide variety of more complex to more straightforward embodiments of powering on the fans **1308**, in a way that does not exceed the tolerances of components of the board **1300**.

FIG. **15** is a simplified perspective view of the fan controller board **1300** of FIG. **13**, according to an embodiment of the invention. As shown in FIG. **15**, the board **1300** includes the PCB **1302** along with the other components disclosed with reference to FIG. **13**. FIG. **15** also highlights the modular design aspects of various embodiments disclosed herein, including components of the power source **1310**, components of the voltage key **1314**, and the on-board diagnostics indicators **1328**. For example, according to one embodiment, the power source **1310** includes a power cable **1502** that connects to the PCB **1302** through mating portions of a connector **1504**. The power cable **1502** can connect to one or more other electrical components, such as, for example, a motor controller board. Connection from a motor controller board advantageously allows the power source

13

1310 to connect to power, such as AC power, which has been filtered to reduce, for example, power spikes, harmonics, or the like. Alternatively, power cable 1502 may connect to traditional residential or industrial power outlets.

FIG. 15 also shows an embodiment of the voltage key 1314 including a receptacle 1506 and two electrically mating plugs 1508 and 1510. As disclosed with reference to FIG. 16, the voltage key 1314 configures the wiring connected to the primary side of the transformer 1304. According to one embodiment, a 220 volt plug 1508 includes about 22 or 12 AWG gauge wire sturdily connected to contact leads within the plug 1508, thereby configuring the transformer 1304 such that the magnetic flux is complementary for the primary windings. Moreover, such configuration provides for ease of maintenance and configurability for users of the exercise machine. For example, the wire is looped such that one or more fingers are easily hooked through the wire to provide a leveraged pull on the plug 1508, thereby removing the plug 1508 from the electrically mating receptacle 1506. According to one embodiment, the plug 1508 includes a releasable hook mechanism which catches on the receptacle 1506 to ensure the plug 1508 remains positioned in electrical contact with the leads of the receptacle 1506.

Similar to plug 1508, a 110 volt plug 1510 includes, according to one embodiment, similar wire of a distinguishing color. The wire is also sturdily connected to contact leads within the plug 1510 and configures the transformer 1304 such that the magnetic flux through at least one portion of the primary windings contradicts the magnetic flux through other portions of the primary windings, thereby causing a load on the secondary windings to receive the same or similar voltage to that when using the 220 volt power source 1310 and the 220 volt plug 1508. Similar to plug 1508, the wire of the plug 1510 is looped such that one or more fingers can hook through the wire and pull the plug 1510 from the electrically mating receptacle 1506.

FIG. 15 also shows the on-board diagnostic indicators 1328. As disclosed in the foregoing, the diagnostic indicators 1328 may comprise LEDs, multi-colored LEDs, LCDs, a combination of the same or the like, representing, for example, the user selected speed setting and one or more fault indicators, such as, for example, improper polarity in the voltage used to drive the fans 1308, or some other fault detected by the integrated circuit 1306. As shown in FIG. 15, one embodiment of the on-board diagnostic indicators 1328 includes an LED for "LOW" and "HIGH" speed settings, and green and red LEDs (i.e., single LEDs with capabilities for showing both green and red) showing the status of the polarity being applied to the fans 1308.

According to one embodiment, the console 36 can include information display arrangements 76 providing feedback to the user of the status of the fans 1308. For example, according to one embodiment, the information display arrangements 76 can include one or more fan speed indicators, such as one or more animated fans or rotating fan blades. For example, when the fan blades are stationary, the fans are "OFF." Alternatively, when the fan blades are rotating the fans are moving. In an embodiment where the user can select between "HIGH," and "LOW," the animated fan blades may rotate at two or more different user-discernable speeds corresponding to the user selected fan setting. These animation rotation speeds advantageously can be much slower than the rotating speed of the fans 1308 to ensure the user can discern the different settings.

14

FIG. 16 is one example of a circuit diagram of the fan controller board 1300. The particular values involved with various electronic components in this embodiment are disclosed in Table 3.

TABLE 3

REFER- ENCE	PART	REFER- ENCE	PART
10	C1, C2, C5, C6	J4, J7	MOLEX 43045-0424
	C12, C3	J6	MOLEX 42019-3212
	C4	Q1, Q2	STP30NE06L
	C7	Q3	2N3904
	C8, C9	R1, R4, R7, R11, R14	12K
15	C10	R2, R3, R9, R15, R16, R17, R18	1K
	C11	R5	470
	D1	R6	39K
20	D3, D7	R8	24K
	D5, D6	R10	9.1K
	D12	R12, R13, R20	22K
	D13, D14	R19, R22, R23	100K
25	D15	T1	MCI-4-44-7010
	F1, F4	U1	LM7805
	F2, F3	U2	PIC16C711_P
	JP1	Y1	4.0 MHz

Although the foregoing invention has been described in terms of certain preferred embodiments, other embodiments will be apparent to those of ordinary skill in the art from the disclosure herein. For example, the foregoing toggled or soft start, or its embodiments, may be employed in virtually any circuit which drives a load that can pull near or more current than is appropriate for circuit components. For example, the soft start can be used to power on a person cooling system employing a large chassis-mounted transformer. Moreover, the fans may be voltage-controlled as opposed to the foregoing control using PWM. Also, the user may adjust the fan speed through buttons, turnable knobs, or the like. Also, AC fans may be used in the personal cooling system.

With reference now to FIGS. 17–21, several embodiments of a display console and adjustable openings, such as vents, are arranged and configured in accordance with certain features, aspects and advantages of the present invention. For example, FIGS. 17–18 illustrate a display console 1700 having an adjustable center opening 1702, according to an embodiment of the invention. As shown in FIGS. 17–18, the adjustable center opening can include manual or automatic rotatable grills, louvers, or vents 1704, configured to remain positioned when the user adjusts the openings to his or her particular preference, such as, for example, the user's height. A wide number of alternative configurations can be used for the openings 1702 and the rotatable vents 1704. For example, the display console 1700 can include multiple openings designed to provide direction to air flow, such as, for example, side openings similar to those discussed with reference to FIGS. 1–11, bottom openings, the foregoing top opening 1702, combinations of the same, or the like. Moreover, the rotatable vents 1704 could be vertically or horizontally mounted in the openings, provide for vertical and/or horizontal adjustment, be configured similar to the nozzle or gimbal arrangements disclosed in the foregoing, combinations of the same, or the like.

FIGS. 19 and 20 illustrates front, back, and side views of a display console 1900 having an adjustable center opening

1902, according to another embodiment of the invention. As shown, the display console 1900 is formed of a group of suitable plastic moldings, generally comprising front and rear pieces, similar to and for the advantages of, the display console 36 disclosed in the foregoing. FIGS. 20A and 20B also illustrate air intake and ducting 2000 for a personal cooling system similar to those disclosed above.

FIG. 21 is a perspective view of the display console of FIG. 19, with the back panel removed to show a fan assembly 2100, such as, for example, a squirrel cage fan 2102 and ducting 2104 providing air flow for the center opening 1902.

Although the present invention has been described in terms of a certain embodiment, other embodiments apparent to those of ordinary skill in the art also are within the scope of this invention. For instance, a single switch can be used to perform each of the steps of the sequence described above. Thus, various changes and modifications may be made without departing from the spirit and scope of the invention. For instance, various components may be repositioned as desired. Moreover, not all of the features, aspects and advantages are necessarily required to practice the present invention. Additionally, other combinations, omissions, substitutions and modifications will be apparent to the skilled artisan in view of the disclosure herein. Accordingly, the scope of the present invention is intended to be defined only by the claims that follow.

Additionally, all publications, patents, and patent applications mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication, patent, or patent application was specifically and individually indicated to be incorporated by reference.

What is claimed is:

1. A display console for an exercise machine comprising a housing, the housing defining an opening, an integrated display electronics assembly having an outer perimeter that generally corresponds to said opening, said display electronics assembly comprising a keypad panel, a display panel and an electronics panel, said keypad panel and said display panel abutting each other, said electronics panel being spaced from said keypad panel and said display panel by standoffs, a plurality of fasteners securing said display electronics assembly within said opening, and said electronics panel comprising connectors that are adapted to place said display electronics assembly in electrical communication with a power supply and a controller.

2. The console of claim 1, wherein said housing comprises a front panel and a rear panel that are secured together and said front panel defining said opening.

3. The console of claim 2, wherein said plurality of fasteners extend through at least a portion of said rear panel.

4. The console of claim 3, wherein said keypad panel overlies at least a portion of said display panel.

5. The console of claim 1, wherein said connectors extend rearward from said electronics panel.

6. The console of claim 1, wherein said electronics panel is set off from said keypad panel and said electronics panel by a first set of standoffs and said keypad panel and said electronics panel is set off from said rear panel by a second set of standoffs.

7. The console of claim 1, wherein said plurality of fasteners comprise threaded fasteners.

8. A display console for an exercise machine comprising a housing, the housing comprising a front wall and a rear wall, said front wall being positioned between said rear wall and a user, a recess defined within said housing between said front wall and said rear wall, an opening into said recess defined within said front wall, a display electronics assembly having an outer perimeter that generally corresponds to said opening, said display electronics assembly comprising a keypad panel, a display panel and an electronics panel, said keypad panel and said display panel abutting each other, said electronics panel being spaced from said keypad panel and said display panel by standoffs, a plurality of fasteners securing said display electronics assembly within said opening by securing one of said keypad panel, said display panel or said electronics panel to said housing, said electronics assembly being removably positioned within said recess and said electronics assembly being sized and configured for removal from said recess through said opening.

9. The display console of claim 8, wherein said display panel is secured to said housing by said fasteners.

10. The display console of claim 9, wherein said display panel is secured to said rear wall of said housing.

11. The display console of claim 9, wherein a portion of at least one standoff extends through said electronics panel.

12. The display console of claim 8, wherein said electronics panel comprises at least one connector that is adapted to place said display electronics assembly in electrical communication with a power supply and a controller.

13. The display console of claim 11, wherein said connector comprises a pluggable coupling.

14. A display console for an exercise machine comprising a housing, said housing comprising a front wall and a rear wall, said front wall positioned between said rear wall and a user, an opening formed in said front wall of said housing, an electronics module comprising a keypad panel, a display panel and an electronics panel, said electronics module being removably positioned within said opening, a plurality of fasteners securing said module within said opening, said fasteners extending through said rear wall of said housing and into a rearwardly facing portion of said electronics module.

15. The display console of claim 14, wherein at least a portion of said keypad panel and said display panel abut each other.

16. The display console of claim 15, wherein said electronics panel is spaced from said keypad panel and said display panel by standoffs.

17. The display console of claim 16, wherein at least one standoff extends through said electronics panel.

18. The display console of claim 14, wherein said electronics panel of said electronics module comprises connectors that are adapted to place said display electronics module in electrical communication with a power supply and a controller.

19. The display console of claim 14, wherein said electronics module is spaced from said rear wall by a plurality of standoffs.

20. The display console of claim 19, wherein at least a portion of said standoffs extend rearwardly from said electronics module and said fasteners extend into said standoffs.